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BSc THESIS

Designing a mobile application-driven gamified experience to support the Train the Trainer framework

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ΤΜΗΜΑ ΠΛΗΡΟΦΟΡΙΚΗΣ ΚΑΙ ΤΗΛΕΠΙΚΟΙΝΩΝΙΩΝ

ΠΤΥΧΙΑΚΗ ΕΡΓΑΣΙΑ

Σχεδιασμός καθοδηγούμενης από εφαρμογή παιγνιώδους εμπειρίας για κινητά για την υποστήριξη του μοντέλου Κατάρτισης Εκπαιδευτών

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ABSTRACT

Nowadays, in-person training workshops employ several digital tools to enhance participant involvement, collaboration, and productivity, with facilitators being responsible for suitably integrating them into the learning experience. Digital tools assist the training process but ultimately are secondary components of a broader learning experience determined by the facilitators.

This thesis investigates the design process of a mobile web application that coordinates and guides, concurrently with the facilitator, the entire learning experience of a training workshop, specifically for contexts revolving around the training of trainers. Inspired by a non-digital training card game, the application intends to provide facilitators with a structured and customizable framework to carry out their trainings and participants with an interactive and engaging learning experience that combines game-based elements with real-world tasks. Interactive, high-fidelity prototypes were developed, adopting well-established interface and interaction design principles, capturing the application's experience from the participant's perspective. The final prototypes were evaluated by the card game's inventor, an experienced workshop consultant, providing insight into the usability and meaningfulness of the design. We conclude that the results are promising, recommending further research to address the limitation of our evaluation sample and to approach the experience from additional perspectives.

SUBJECT AREA: Human-Computer Interaction

KEYWORDS: User experience design, Interface design, Gamification, Designing for mobile, Usability, Train the Trainer framework

ΠΕΡΙΛΗΨΗ

Στις μέρες μας, τα δια ζώσης επιμορφωτικά εργαστήρια επιστρατεύουν διάφορα ψηφιακά εργαλεία για την ενίσχυση της συμμετοχής, της συνεργασίας και της παραγωγικότητας των συμμετεχόντων, με τους συντονιστές να είναι υπεύθυνοι για την κατάλληλη ενσωμάτωσή τους στη μαθησιακή εμπειρία. Τα ψηφιακά εργαλεία βοηθούν την εκπαιδευτική διαδικασία, αλλά στην ουσία αποτελούν δευτερεύοντα δομικά στοιχεία μιας ευρύτερης μαθησιακής εμπειρίας που καθορίζεται από τους συντονιστές.

Η παρούσα πτυχιακή εργασία διερευνά τη διαδικασία σχεδιασμού μιας διαδικτυακής εφαρμογής για κινητά που οργανώνει και καθοδηγεί, ταυτόχρονα με τον συντονιστή, ολόκληρη τη μαθησιακή εμπειρία ενός επιμορφωτικού εργαστηρίου, συγκεκριμένα στα πλαίσια που αφορούν την εκπαίδευση εκπαιδευτών. Εμπνευσμένη από ένα μη ψηφιακό επιμορφωτικό παιχνίδι καρτών, η εφαρμογή σκοπεύει να παρέχει στους συντονιστές ένα δομημένο και προσαρμόσιμο υπόδειγμα για τη διεξαγωγή των εκπαιδεύσεών τους και στους συμμετέχοντες μια διαδραστική και συναρπαστική μαθησιακή εμπειρία που συνδυάζει στοιχεία παιχνιδιών με καθήκοντα του πραγματικού κόσμου. Αναπτύχθηκαν διαδραστικά πρωτότυπα υψηλής πιστότητας, υιοθετώντας καθιερωμένες αρχές σχεδιασμού διεπαφών και αλληλεπίδρασης, αποτυπώνοντας την εμπειρία της εφαρμογής από την οπτική γωνία του συμμετέχοντα. Τα τελικά πρωτότυπα αξιολογήθηκαν από τη δημιουργό του παιχνιδιού καρτών, μια έμπειρη σύμβουλο εργαστηρίων, παρέχοντας μια εικόνα για τη χρηστικότητα και τη σημασία του σχεδιασμού. Καταλήγουμε στο συμπέρασμα ότι τα αποτελέσματα είναι πολλά υποσχόμενα, συνιστώντας περαιτέρω έρευνα για την αντιμετώπιση του περιορισμού του δείγματος αξιολόγησης και για την προσέγγιση της εμπειρίας από πρόσθετες προοπτικές.

ΘΕΜΑΤΙΚΗ ΠΕΡΙΟΧΗ: Αλληλεπίδραση Ανθρώπου-Υπολογιστή

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: Σχεδίαση εμπειρίας χρήστη, Σχεδίαση διεπαφών, Παιχνιδοποίηση, Σχεδιασμός για κινητά, Ευχρηστία, Μοντέλο Κατάρτισης Εκπαιδευτών

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PREFACE

This project was developed at the Department of Informatics and Telecommunications of the National Kapodistrian University of Athens as a bachelor thesis. Its duration from start to completion was one year.

1. INTRODUCTION

1.1 Project topic and motives

Despite their similarities, training workshops are distinguishable from other educational meetings, such as seminars and conferences, primarily due to their practical nature. A training workshop approaches the learning process constructively through working and learning from practical experiences by actively involving its participants with interactive group discussions, exercises, and activities [1].

Facilitators are an integral part of any workshop since they organize the workshop activities and provide theoretical and practical guidance to participants at every step to help them achieve their tasks. This entails that the quality and effectiveness of a workshop's learning process relies on the facilitator's expertise in preparing and implementing interactive and engaging workshop activities suitable for their audience's needs and goals and in their ability to guide them through the experience. Consequently, facilitators are responsible for balancing out the intriguing and enjoyable aspects of a workshop with the sought-after practical and real-world learning outcomes.

Technology has aided the tasks of facilitators by supplying them with an abundance of digital tools to incorporate in their workshops. They vary from survey and whiteboard tools to note-taking applications. However, to our knowledge, no digital tools have yet attempted to simulate the role of a facilitator to provide participants with a complete workshop experience on its own, in coordination and collaboration with the actual facilitator. It is, then, of particular interest to ascertain whether and how a digital tool can direct all members and activities of a workshop while satisfying both the participants' and the facilitators' needs and goals simultaneously.

Defining this project's context, we were inspired by a non-digital card game [2], which we examine in detail in a subsequent chapter, portraying a workshop experience intended for training trainers, providing the foundation of our approach.

1.2 Project goal

The goal of this project is to design and prototype a practical web application-driven experience for training trainers. The project explores how an application can enhance the workshop experience, making it more interactive, engaging, and organized for both participants and facilitators. Within this project's scope, we conceptualize and describe the general idea of the application, subsequently focusing on the participant's experience of the mobile environment.

1.3 Thesis structure

The structure of this thesis and the primary focus of each chapter are as follows:

Chapter 2 contextualizes and analyzes the theoretical framework that underlies our design process.

In Chapter 3, we follow our design process from ideation to prototyping, outlining and justifying our design choices.

Chapter 4 discusses the procedure and findings of the design's evaluation.

Finally, Chapter 5 summarizes and reflects on the project's outcomes and recommends potential future work areas.

2. BACKGROUND

2.1 The Train the Trainer framework

Since we are designing an application based on a Train the Trainer framework, we need to grasp the framework's underlying notions. Within the current section, we study the framework's definition, objectives, training methods, benefits, and limitations.

2.1.1 Definition

Train the Trainer, also known as Training of Trainers, is an instructional framework commonly used in organizations to educate trainees on a predetermined topic or skill while simultaneously preparing them to teach this training content to other people. Courses utilizing the Train the Trainer framework consist of experienced trainers proficient in a particular training topic or skill instructing less experienced participants, most likely trainers or future trainers, typically using varied training methods and interactive activities. These courses may differ in length and form, ranging from a single day to multiple weeks and adjusted according to the organizational needs, resources, and participant's background knowledge. Therefore, the framework is adapted and deployed by organizations of differing goals, backgrounds, and environments [3], [4], [5].

2.1.2 Objectives

Regardless of the training topic, the key objective of a Train the Trainer course is to enable participants to apply their newly acquired skills and knowledge in their future personal training courses by introducing and reinforcing several applicable trainer skills, practices, and qualities. A Train the Trainer course should provide a chance for participants to exercise and strengthen a few practical trainer characteristics, including [4]:

- Communication skills: talking, listening, and using non-verbal cues efficiently.
- Organizational skills: researching training resources effectively and preparing a well-organized training structure.
- Understanding the audience's needs by having a participant-centered approach.
- Deploying suitable training methods and interactive problem-solving activities depending on the occasion.
- Associating the training course with the participant's jobs and responsibilities.
- Keeping the audience engaged with clear learning goals and facilitative skills.
- Assessing the audience's performance and self-assessment.

Note that the Train the Trainer course trainer(s) must also possess and deploy the above trainer characteristics for successfully designing and delivering a Train the Trainer course.

2.1.3 Training methods

A course utilizing the Train the Trainer framework typically consists of multiple training methods to provide an engaging, interactive, and productive learning experience for both the participants and the course trainer(s). In other words, a Train the Trainer course operates similarly to a workshop: getting participants fully involved in the learning process with practical and often team building activities such as group discussions, brainstorming, and role-playing exercises, in which they have to think, process, work, and then practice employing the training content. Since not all training methods fit in every Train the Trainer course, carefully choosing a subset of training methods positively affects the viability and sustainability of the training course [5].

2.1.4 Benefits and limitations of the framework

The Train the Trainer framework is often preferred over other training models for numerous reasons. First of all, training a group of trainees with a single Train the Trainer course who will later deliver this knowledge to their colleagues results in a consistent training course across the organization, a quick knowledge distribution, and a less costly alternative contrary to multiple training sessions. Moreover, teaching others is an effective way to learn and improve personal expertise on a particular subject. Last but not least, since participants usually belong to the same organization as their future trainees, coaching and assisting colleagues is more convenient and coworker-centered when trainers are familiar with the organization's overall philosophy, environment, and goals [6].

On the other hand, it is reasonably expected for the framework to have some limitations as well. The Train the Trainer framework sometimes follows an abstract, top-down instruction style, meaning that participants must generate and improve their knowledge through immersion, open discussions, and self-experience association. So, the framework lacks emphasis on situations where focusing on a specific topic's details has priority over the topic's bigger picture, which may not be ideal in every scenario [7]. As an additional consequence of the framework's top-down approach, participants must have an adequate training topic knowledge level and overall trainer expertise to be successfully involved in the training course. Finally, the process of both learning and teaching a topic in the same training course restricts the time available for individual participant-centered needs [3].

2.2 Human-computer interaction (HCI)

The Special Interest Group on Human-Computer Interaction (SIGCHI) of the Association for Computing Machinery (ACM) defines human-computer interaction (HCI) as "the discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" [8]. HCI studies aim to improve human-computer interfaces, meaning the medium that aids the communication and interaction between humans and computing systems. The field's findings yield principles to assist the design of computing systems that are usable and tailored to their users and their needs, providing a good user experience (UX) [9].

This section covers two central concepts of the HCI field: usability and user-centered design. Note that these concepts are applicable in both digital and non-digital contexts, and we do not concentrate on either context while describing them. The design approach that our project follows builds upon the principles described in the following sub-sections.

2.2.1 Usability

ISO 9241-11, a standard of the International Organization for Standardization (ISO), defines usability as "the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [10]. In simpler terms, usability measures how easy and pleasant user interfaces are to use. According to Jakob Nielsen, usability incorporates five quantifiable components [11]:

- **Learnability.** How easy is it for users to accomplish basic tasks the first time they encounter the design?
- **Efficiency.** How quickly can users perform tasks once they have learned the design?

- **Memorability.** When users return to the design after not using it for some time, how easily can they reestablish proficiency?
- **Errors.** How many errors do users make, how severe are these errors, and how easily can they recover from them?
- **Satisfaction.** How pleasant is it to use the design?

As the ISO standard's definition suggests, assessing usability is meaningful only when users, goals, and context of the design are explicitly determined. Also, usability does not define the extent of the design's functionality. To design something useful, we must take into account both utility and usability [11].

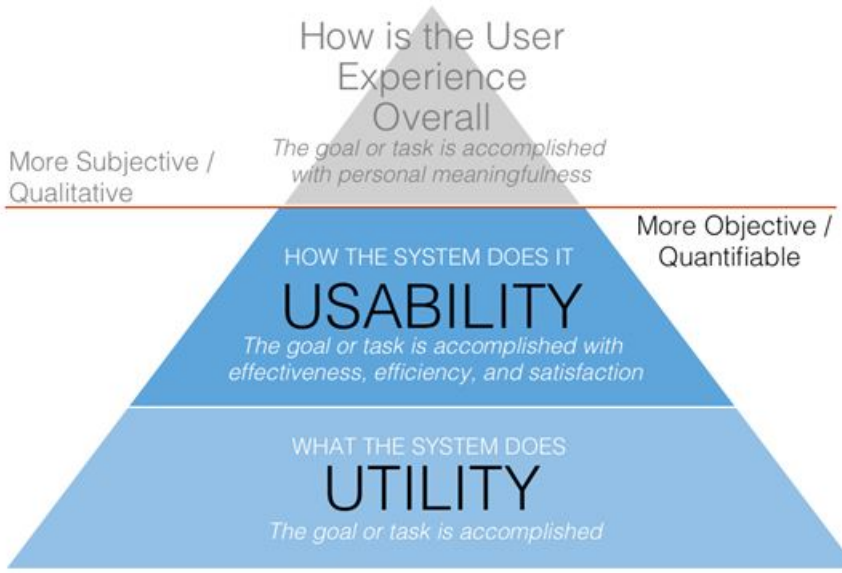

Figure 1: Usability hierarchy. Source: [12]

Since usability is measurable, researchers have developed several sets of broad usability principles for designing and evaluating systems, or "heuristics" as regarded. These heuristics aim to provide designers and evaluators guidance on what a usable system should or should not have, defining and identifying usability problems. Nielsen introduced probably one of the most influential sets of usability heuristics, proposing the following ten principles [13]:

1. **Visibility of system status.** The design should always keep users informed about what goes on by providing appropriate feedback promptly. The system's status should be communicated clearly to users to expect the outcomes of their actions.
2. **Match between system and the real world.** The design should speak the user's language using words, terms, icons, and concepts familiar to the user, following real-world conventions and structuring information naturally and logically.
3. **User control and freedom.** The design should be forgiving to users by providing obvious and fast ways to undo and redo unwanted actions and the ability to cancel and restart tasks.
4. **Consistency and standards.** The design should prevent users from wondering whether different words, situations, or actions mean the same thing by following platform and industry conventions and being consistent internally and externally.
5. **Error prevention.** The design should ideally prevent errors from occurring in the first place. Otherwise, it should warn users before they commit to an action.

6. **Recognition rather than recall.** The design should minimize the information that users have to remember by making available elements, actions, and options visible and required information easily retrievable.
7. **Flexibility and efficiency of use.** The design should permit users to choose whether they want to do more or less, based on their experience. It should include shortcuts, personalization, and customization options, so the content and functionality of the design are tailored for each user separately.
8. **Aesthetic and minimalist design.** The design should not distract users from important content by avoiding having information and visual elements irrelevant to the user goals or rarely needed.
9. **Help users recognize, diagnose, and recover from errors.** The design should express errors in plain language without error codes, accurately indicating the problem and suggesting a solution constructively.
10. **Help and documentation.** Even though it is best if the design does not need any additional explanation, it may be necessary to provide help and documentation. It should be simple to search, concise, and focused on the user's task, containing concrete steps to be carried out.

2.2.2 User-centered design (UCD)

During the design process, it is essential to judge whether the design can satisfy the desired requirements. But how do we measure the usability and overall user experience that a design provides considering the uncertainty factor of the user's behavior? By including the human element in the equation, acknowledging typical users and their interaction with the design within specific contexts of use. This approach suggests that if the design builds around the user and their needs throughout the design process, the final product is more likely to be usable and meaningful. It is a philosophy known as user-centered design (UCD) or human-centered design (HCD), as it is often called [9].

As shown in Figure 2, a user-centered design is an iterative process that involves identifying the need for user-centered design, understanding and specifying the context of use, specifying the user and organizational requirements, producing design solutions, and evaluating the design against requirements. Iterations through these phases continue until the evaluation yields satisfactory results [9].

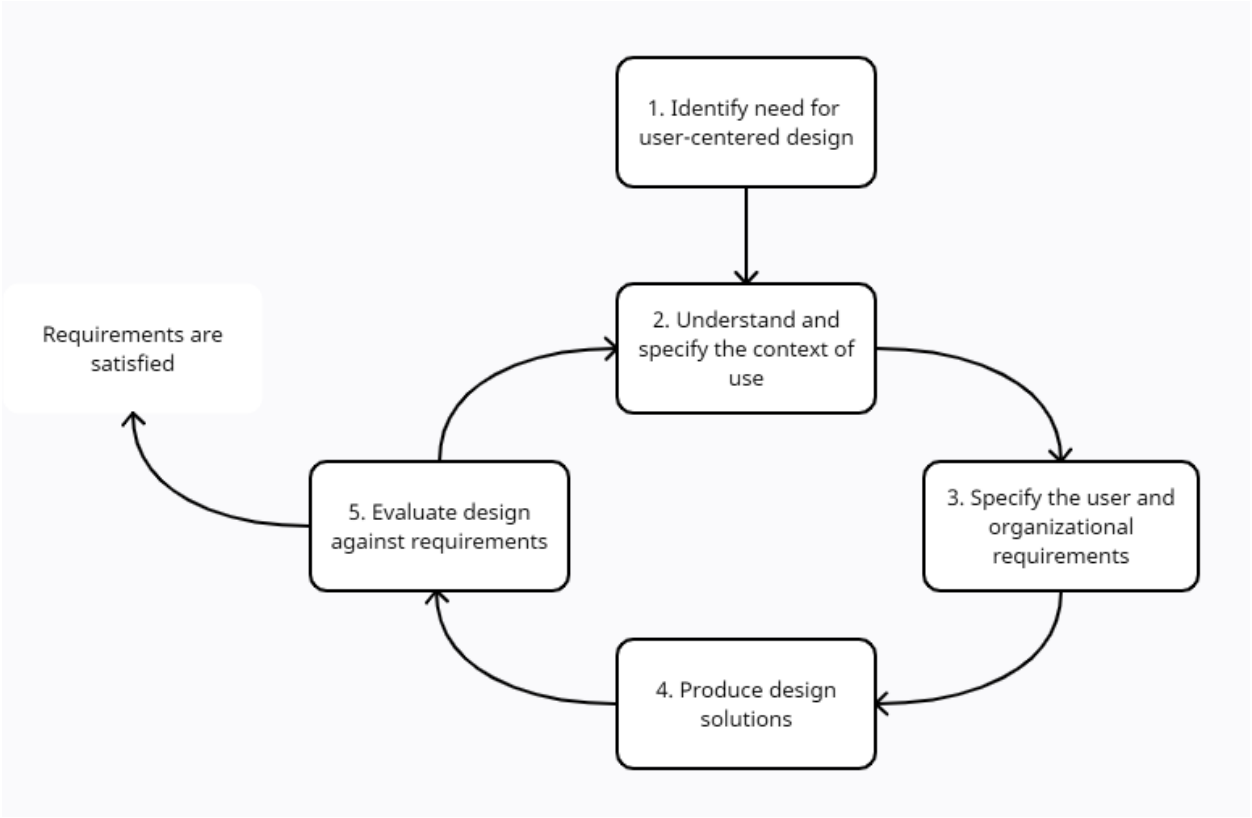

Figure 2: Iterative process of user-centered design. Source: Adapted from [9]

Researchers suggest satisfying the following six principles to ensure that a design is user-centered [9]:

1. The design needs to build upon a clear understanding of users, tasks, and environments. Additionally, it should be expected and accepted that one's good user experience might not be equally viable for another.
2. Users should be involved throughout the design and development process. User involvement is meaningful in all phases of the process, not only at the early or final stages.
3. Users should be involved in evaluating the design during all process phases, from early prototypes to final solutions.
4. The process must be iterative. Users usually have a hard time explaining what they want, making it challenging, if not impossible, to design something appropriate on the first try. Instead, when users encounter unwanted features in a design, designers can better understand what users want and, consequently, modify or improve the design based on the interactions and comments of the users.
5. The design should consider the whole user experience, including perceptual and emotional aspects, not just the ease of use.
6. The designer team should incorporate multidisciplinary skills and perspectives.

Overall, a user-centered design approach helps designers empathize with users and discover what works well for them, what does not and why. Users can uncover many overlooked positive or/and negative aspects of the design, such as usability and accessibility matters. Ultimately, UCD leads to safer and more inclusive products [14].

2.3 Designing for mobile

As the goal of the application is to be used in situ, at a training workshop by different participants, a mobile approach was deemed more appropriate due to the flexibility and availability of mobile devices. Thus, in this project, we focus on the mobile end of our web application, following a mobile-first design approach. This approach proposes that the design process should start from determining and providing only the most user-relevant content on the mobile environment because of the smaller screen sizes. Then, the design process can proceed to devices with less limited screen sizes and, supported by the insight gained in the first phase, can acknowledge, build on, and enhance the significant-considered content, taking advantage of the extra screen space. Therefore, the user experience that a web application offers is consistent on all devices [15]. While laptop and desktop environments are outside of this project's scope, our mobile-first approach encourages and assists possible future adaptations on such devices.

Figure 3: Mobile-first design. Source: Adapted from [16]

Interacting with mobile devices is inherently different from laptop and desktop experiences, and even between mobile users, there are differences in how they choose to interact with their devices. The mobile environment features beneficial elements, like the availability of sensors, and restricting factors, such as the already-mentioned smaller screen sizes. Consequently, mobile designs must consider many different aspects of the mobile environment to provide a good user experience. On top of the discussed HCI principles of the previous section, there are additional general guidelines for designing for mobile. Some of them apply to other environments as well but are especially important for mobile. These guidelines include good mobile design practices such as [17]:

- Decluttering. Keep only the most necessary content and interface elements in the design. Use progressive disclosure to present more actions and information after interacting with the interface.
- Dividing tasks into multiple, smaller subtasks.
- Minimizing user input and offer alternative input mechanisms.
- Keeping interactive elements familiar and predictable.
- Using gestures with caution. Gestures have low discoverability as they are hidden controls. Use widely accepted gestures and offer gestures as a supplement to, not a replacement for, visible navigation options.
- Optimizing content for mobile. Make text readable and legible. Design finger-friendly touch targets.

2.4 Gamification

In this section, we examine gamification as a technique to improve a design's overall user experience and user satisfaction. Given our project's instructional setting and rationale, we believe that gamification further supports our goals. Thus we decide to include several

gamification elements in our design, partially influenced by current successful implementations.

2.4.1 What is gamification?

Gamification is a heavily contested term, lacking a ubiquitously accepted working definition. One of the most commonly adopted definitions of gamification is proposed by Sebastian Deterding and his group in 2011, defining the term as “the use of game design elements in non-game contexts” [18]. While the term is relatively new, first emerging in the early 2000s, the concept of gamification dates back to the late 1890s where retailers rewarded customers with stamps for their loyalty [19]. Even though modern gamification instances are mainly digital, the term addresses both digital and analog contexts and is not bound to a single setting.

The primary difference between other game-related concepts and gamification is intention. Gamification aims to enhance learning, engagement, and motivation within non-gaming processes by applying game-based elements and strategies, making the experience less dull and more fun [20]. However, a process must already be functional and usable for effectively incorporating gamification, as previously considered and illustrated in Figure 1. Gamification attempts also need to be relevant and associated with the process and its target audience. Gamifying a flawed process or/and inappropriately gamifying a functioning process does not improve the process [21].

2.4.2 Main elements

Naturally, a gamified process cannot target the preferences of every single person simultaneously. There is no single best path in applying gamification effectively since countless contexts and people exist, and countless new ones will arise in our rapidly changing world. Nonetheless, some key game design elements appear throughout successful gamification practices. This mutual set of gamification elements includes [21]:

- **Goals.** They provide purpose to the process and a sense of accomplishment and advancement when achieved.
- **Rules.** They define the ways to approach and achieve the goals, creating a challenge and opportunities for creativity.
- **Feedback.** It informs people of their progress, how well they are doing concerning the goals and rules of the process, and how close they are to completion.
- **Rewards.** They compensate for the time and effort that people spend in the process, and they can be either virtual or material.
- **Motivation.** The drive that makes people undertake the process. People may be motivated by the rewards associated with the process completion or by the process itself.
- **Freedom of choice.** It ensures that people participate in the process in their preferred way, and because of their own conscious and voluntary choice and not due to manipulation or coercion.
- **Freedom to fail.** It expects, allows, and encourages people to fail during the process by letting them try again, engaging them, and enabling them to reach success by learning from their mistakes.

2.4.3 Applications and current examples

Besides a definition, in 2011, Deterding and his group also proposed “not limiting the term gamification to specific usage contexts, purposes, or scenarios” as they argued there are no apparent benefits in doing so [18]. Almost a decade later, the employment of

gamification is widespread and unquestionably not bound to a specific application area. Current fields that utilize gamification are, amongst others, health, education, and business [20].

Below are two separate current examples of companies implementing gamification in their products: Fitbit and Duolingo. In both cases, we observe in practice the previously mentioned main gamification elements within digital contexts [21].

Fitbit

Fitbit is a fitness company that produces wearable devices to track fitness-related data such as the number of steps walked and heart rate. The goal and rules are simple: reach a certain number of steps daily by walking. Fitbit displays user's progress with progress circles and counters. It rewards the user with virtual badges and trophies for reaching certain milestones and incorporates a leaderboard system using steps as placement currency. Motivation for user commitment comes from both the virtual rewards and the process of becoming physically healthier. Fitbit neither forces users to reach a goal every day nor punishes them for failing to do so.

Figure 4: Gamification in Fitbit

Duolingo

Duolingo is a company primarily known for its same-named language-learning platform, which aims to familiarize and teach users new languages through provided sequential lessons and exercises. It utilizes progress bars, progress circles, and weekly overviews to provide feedback on lesson advancements. As users move through lessons, they acquire digital rewards in the form of hot streaks, badges, and experience points, through which they can compare their progress with other individuals. Besides digital achievements, learning new languages is a motivator on its own for personal or/and professional development. Users determine which of the available languages to start/continue learning and when they want to do so, able to revisit past learning material and switch between different lessons. Duolingo offers unlimited retries on failed lessons and exercises, encouraging users to practice and improve their skills.

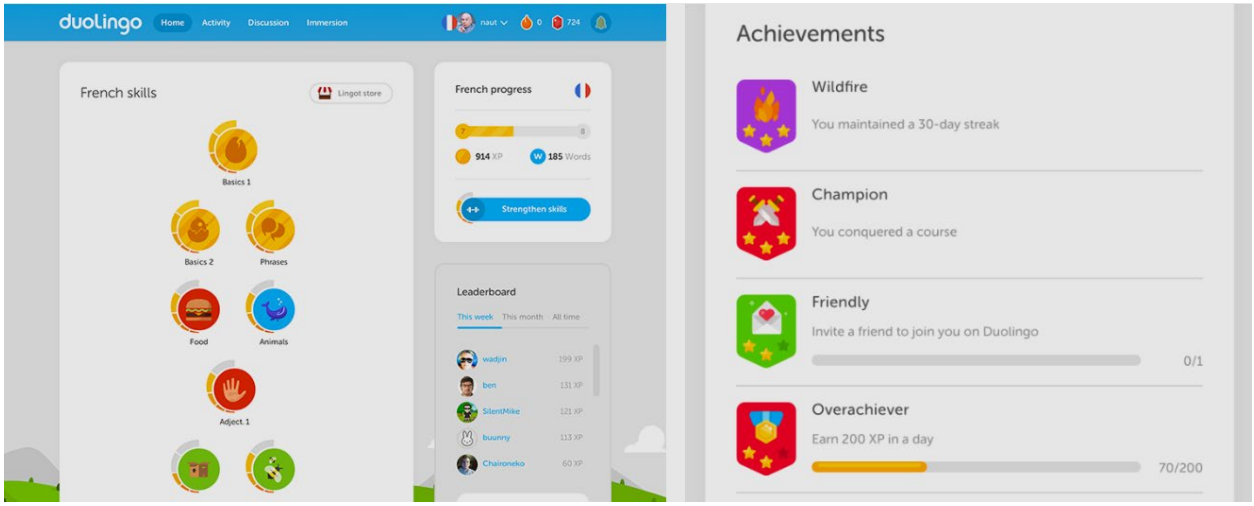

Figure 5: Gamification in Duolingo

2.4.4 Appeals and concerns

Various incentives exist for including gamification in processes for both users and designers. The increasing adoption of smartphones in the last years causes gamified processes to be less complex to design and more convenient to access. The capabilities and sensors of today's smartphones assist in tracking and subsequently gamifying numerous daily activities. Since people are familiar with games and play them for amusement, they are engaged by and appreciate game characteristics in non-game contexts, reminding them of pleasant and fun experiences. Finally, based on its previously mentioned main elements, a successfully gamified process is structured in such a way that motivates and guides people to achieve real-world tasks [20], [22].

However, successfully implementing gamification is challenging, resulting in many poor implementations that undermine experiences rather than improve them. Out-of-place gamification elements unrelated to the process, and processes that do not have explicit goals and a specific target audience, fail to enhance engagement. Gamification processes that force users to have fun heavily weaken motivation. Focusing too much on game elements is misleading and counter-productive since gamification aims to engage users in carrying out non-gaming, real-world tasks. Lastly, as noted before, gamifying subpar processes does not make them successful [22].

3. DESIGN

This chapter covers the project's design process, discussing and justifying our design choices in each step. Specifically, we begin by introducing and analyzing the existing physical Train the Trainer card game, which our application builds on. We then outline the digital Train the Train experience and its target audience considering both current and new ideas and concepts. Lastly, we present our final prototypes of the mobile web application, focusing on the participants' user experience.

3.1 Basic idea: Introducing the physical Train the Trainer card game

The Train the Trainer web application we are designing is based upon an existing physical card game developed by Ms. Gwen Franck to facilitate training workshops on the topic of Open Science [23]. In line with the Train the Trainer framework, the game's objective is to guide potential trainers to prepare suitable training structures in groups through brainstorming and discussion, a process coordinated by workshop consultants. The game features cards that illustrate several significant training variables which groups of participants pick at random during the game, impacting the preparation and the outcome of the groups' training structures [2]. Just like the physical card game, the digital application is intended for use by participants gathered in situ, i.e. typically in a single room or space where the training takes place.

In the rest of this section, we first examine the game's structure in more detail and then showcase the creator's findings and observations on the game in action since they have applied and tested it with actual trainees. Last, we summarize and comment on the insights gathered.

3.1.1 Structure

At the start of the game, participants are split into small groups and choose a training topic. Each group randomly picks one card from each of four categories, determining the conditions for their training: audience size, audience type, audience knowledge level, and training type. Afterward, every participant is provided with a persona sheet to create a convincing attendee profile based on their group's training conditions. Then, the groups prepare training structures, keeping the attendee profiles, and training conditions in mind. When they are ready, each group presents its training, one at a time, by describing its main points without focusing on factual training. Finally, before their presentation, each group randomly picks one card from each of two categories, determining the unforeseen circumstances of their training: audience mood and trouble. To adapt their training design to the newly selected cards, they can choose to discuss these issues during or after their presentation, benefiting from the feedback of the other participants and the workshop consultant on the matter.

Figure 6: Physical cards of the Train the Trainer card game. Source: [2]

As outlined, the cards illustrate six different categories of training variables, four of which pertain to the training conditions and two to the unforeseen circumstances. Each card has a short label and a characteristic icon to portray a training variable. Labels and icons are color-coded based on the card's category to match the category's color. To better clarify the function of the cards in the game, Table 1 lists all available training variable cards, at the time of writing, for each category.

Table 1: Available training variable cards for each category

Category	Available training variable cards
Training Conditions	
Audience size	One-person, small group (2-5), small group (5-10), medium group (10-25), large group (25-50), large group (50-100), extra-large group (>100), unknown
Audience type	Funder, citizen scientist, junior researcher, senior researcher, project coordinator, librarian, policy maker, management
Audience knowledge level	No previous knowledge, theoretical knowledge, basic practitioners, experienced practitioners, mixed: theoretical and practical knowledge, mixed: basic and advanced knowledge, a lot of misunderstanding, mixed: advanced practitioners and no previous knowledge, unknown
Training type	One-on-one training, 1 hour webinar, online course, 1 hour lecture, half-day workshop, full day workshop, multiple day event, 1 hour training
Unforeseen Circumstances	
Audience mood	Shy, hostile, uninterested, language barrier, many questions (and you do not know the answer), skeptical, many questions (but not about the training topic), know-it-all, chaos
Trouble	Insufficient equipment, no internet, noise, unpleasant room, technical issues, distracted audience, forgot something, bad group dynamic

During the game, participants are individually provided with a persona sheet to compose profiles of the expected attendees of their training. At the time of writing, the persona sheet includes five fields: Name, a short biography (occupation, age, education, personality in three words), skills (job experience, knowledge about training topic, training experience, technology), motivation/goals, and frustration. All but one field require writing down the desired details with text, while the skills field has rating scales from one to five for each skill to choose from, with one indicating “no skill” and five “very skilled” correspondingly.

Lastly, the game instructions bring up some additional factors that workshop consultants should consider when employing the card game, presented as follows:

- Participants have, presumably, adequate knowledge of their chosen training topic to successfully organize and deliver their training concepts.
- Participants are (potential) trainers on topics related to Open Science [23]. However, the creator specifies that the game is applicable in different contexts as well.

- The expected duration of the game is between two to four hours. The workshop consultant is responsible for choosing how much time each part of the game requires.
- To have sufficient time for presentations and discussions, the suggested size of each group is two to four participants, and the maximum recommended number of groups is seven.
- If the combination of training variable cards does not meet the group's needs, changing cards or switching cards with another group is allowed.

3.1.2 Findings and observations on the game in action

Being a workshop consultant themselves, the card game's creator has had the chance to employ and test their card game in practice. Therefore, before commencing our design, we chose to hold a semi-structured interview with the creator, who has had facilitated six workshops using their card game at the time of the interview, providing us valuable insight about the game in realistic contexts of use. During the interview, we focused on figuring out the participant's overall experience and reception of the game while also clarifying some technical aspects. Below we present the aggregated findings and observations of the creator from past workshops applying their card game:

- The number of participants typically ranged between twenty to twenty-five. In two workshops, however, they exceeded the expected numbers, having a total of thirty and forty participants.
- Groups were either assigned by the creator randomly or formed by the participants themselves who wanted to train on the same topic.
- Leaders for each group were not strictly assigned, but they showed up organically. Furthermore, one person per group was responsible for the presentation.
- Participants generally chose their training topics during the workshop. Occasionally people were aware that they would have to select a topic and had one in mind before the workshop.
- There was one case where the workshop was not related to Open Science, so people came up with random training topics. The creator commented that it worked well.
- The creator commonly had to advise the groups not to pick vague training topics and urged them to be more specific. Sometimes, they helped less experienced groups who struggled to be more precise by asking relevant questions and giving suggestions based on their answers.
- During the workshop, most queries from participants were about technical matters, like "How detailed do I have to be while filling this form?".
- Having a fixed time frame proved to be an issue when groups had different workloads. Some training conditions are, by their nature, simpler to manage, while some are harder to workaround. Because of that, some groups that finished earlier got annoyed when they had to wait for other groups.
- People who organized the workshops usually chose the participants based on proof, signifying they will use the knowledge gained. Thus, participants were, in general, highly motivated and cooperative as they had to apply to the workshop and be selected to join.

- Besides having two audience-related issues, a “language issue” and a group of uninterested individuals, the creator does not note any other significant problem during the workshops. On top of this discussion, they proposed having an audience of similar knowledge levels as an ideal scenario.
- In general, the participants’ feedback was positive as they liked the gamification attempt. Nonetheless, there was a comment from someone who was annoyed because they used paper instead of digital tools. Additionally, a few participants thought that the presentation lasted too long. Since then, the creator started giving five minutes per group per presentation and says it has worked better.

3.1.3 Summary

In this section, we described the physical Train the Trainer card game. The description and instructions of the game have set out its central ideas and goals, proposing a creative, alternate take on a Train the Trainer activity. However, the game’s different phases are not strictly defined and described in detail. The cards provide playfulness in the process, though their one-time use for designating the training variables seems to contradict the game aspect. Judging by its structure, and as the creator suggests, the game is apt for customization and adaptation depending on the workshop’s goals. Possible adjustments include format, duration, and card changes. Since the card game is, at the time of writing, a new and experimental idea, any suggestion for modifications or/and improvements is highly valued and welcomed.

Our interview with the creator helped us better understand the game’s structure and the participants’ overall experience with it. Workshop participants appreciated the physical card game, yet they experienced some issues concerning selecting an appropriate training topic, the duration of the preparation and presentation phases, and the lack of digital tools.

Keeping in mind the physical card game’s structure, the participants’ feedback, the creator’s insight, and our remarks, we proceed to outline the design of our Train the Trainer digital application.

3.2 Approaching the digital Train the Trainer experience

Having examined the physical Train the Trainer card game in theory and practice, identifying strengths and weaknesses of its current design, we now have a solid foundation to begin conceptualizing a digital Train the Trainer experience. The digital environment provides us with opportunities to enhance the experience, coupled with challenges and limitations that we must consider. With the card game creator’s permission, we decided to modify aspects of the current format, adding new content and ideas, aiming to adapt to the new environment, reinforce the strong points and address the issues of the physical version.

Within this section, we present the basis of the design of our Train the Trainer web application, discussing the unaltered, adjusted, and new format aspects as compared to the physical version. We conclude by sharing our thoughts on the contributions and challenges the digital Train the Trainer experience brings over the physical one.

3.2.1 Format

In this subsection, we analyze all aspects of our Train the Trainer application design one by one in separate segments, explaining and justifying our design choices. Some require an understanding of the whole format’s outline, so we briefly mention them here but further discuss them in individual subsequent subsections.

Gamified application

Even though the creator chooses the term “card game” for the physical version, we argue that “gamified activity” more accurately describes the current process. The training variable cards add a game-based element to a Train the Trainer workshop, a non-game context with non-game goals, to enhance engagement and learning by making the experience more fun, which matches the previously mentioned gamification definition. Regarding its results, the feedback from workshop participants whom the creator facilitated, complimented the gamification attempt of the physical version. Therefore, it is reasonable to consider incorporating current and new gamification elements in our digital experience. By keeping the current gamification elements, the cards, and adding additional ones on top of them, we apply the same logic to our digital context, supporting that “gamified application” better fits the purpose and structure of our approach. The new gamification elements we introduce to the digital experience include a progression system with stages, roles, goals, and a scoring system. We discuss them in detail later, in the “Stages” and “Further gamification” subsections.

Local workshop activity

Shifting towards a digital experience, we now can choose whether the design should support local, remote, or both types of workshops. While “both” appears to be a sensible answer, it adds another layer of complexity to this project, requiring two contrasting approaches for a new experience not tested yet. By designing an experience for multiple contexts, we risk failing to satisfy the requirements of both. Additionally, the participant’s feedback on the current physical version concerns local workshops only. For these reasons, this project focuses on local workshops, although some design choices benefit both types.

Web application: hosting workshop sessions and participating

First, to avoid unnecessary downloads or installs from participants and platform limitations, the digital design is based on the web environment. Next, we require a web-based system to support collaboration between all workshop members, including participants and workshop consultants alike. Searching for a solution, we investigate a method that the Jackbox Party Pack video game series utilizes to address a similar situation, which we briefly outline below.

The Jackbox Party Pack video game series consists of various group games mostly played online. To begin with, a person owning the game starts a game session hosted online on the game’s servers. Then, players, locally or remotely, can join the host’s game session through the internet on their preferred gaming platform. Illustrated in Figure 7, the only requirement to connect to a game session is to insert a name of choice and a short “room code” provided by the host, as possessing a game’s copy is not mandatory [24].

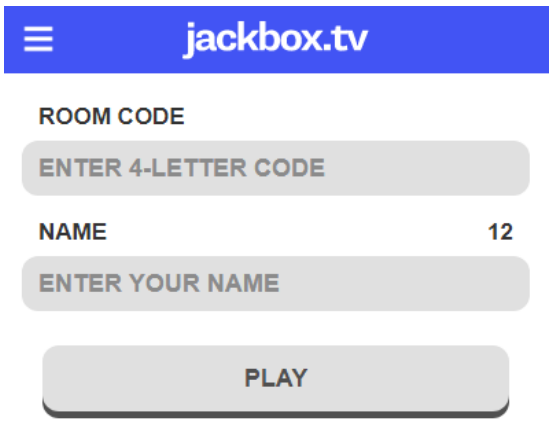

Figure 7: Joining a web-based game session in Jackbox Party Pack

Adjusting the example to our Train the Trainer scenario, facilitators take the role of the host, starting a workshop session beforehand and then giving out a short passcode and nickname to participants to join that specific online workshop session. This practice allows multiple users to connect to the same web-based training activity, even if they use different devices and platforms. The facilitator-provided credentials also eliminate the need for participant personal accounts and unnecessary sign-up and login processes, avoiding further complexity. Lastly, this practice provides future support to having multiple workshop sessions hosted simultaneously.

Mobile application

This project concentrates on the mobile end of our application, following a mobile-first approach. Two deductions support this choice. First and previously mentioned, a mobile-first approach encourages us to find and highlight the most participant-relevant content because of the smaller screen sizes, assisting the current experience and future adaptations on other platforms. Secondly, we speculate that, given the opportunity, smartphones would be the most preferred way of connecting to the web Train the Trainer application in a typical local workshop because of their availability and flexibility.

Duration and course of action

Like the physical version, the expected duration of the experience is between two to four hours, and the workshop consultant can choose and customize each phase's length based on the workshop's needs.

The web application intends to guide participants through the different phases of the activity in parallel with the workshop consultant. For clarity, we split the application's course of action into specific stages, which are described later in the "Stages" subsection.

Participant groups

The number of people in a group may vary between the workshop's groups and between workshops overall. The same applies to the number of groups in a workshop. Allowing flexible group sizes and versatile group numbers is essential for any workshop, and the web application follows the same principle as the physical activity in this regard.

Grouping based on participant preferences

While consulting workshops, the creator mentioned that participant groups were formed either by the workshop consultant randomly or by the participants themselves after discussing their training topic preferences. Therefore, collecting participants' preferences seems helpful for creating groups with similar goals. So, from the very beginning of the Train the Trainer workshop, the web application intends to gather the participants' training topic preferences, along with the introduced role preferences, which we examine later in

the “Further gamification” subsection. Then, the facilitator chooses to either manually assign groups based on the information gathered or automatically, utilizing an embedded, appropriate group-making algorithm. Afterward, participants can view their group, training topic, and role on their device.

Training topics

Instead of discussing with their group and determining their preferred training topic of choice on the spot, participants in a workshop that utilizes the Train the Trainer web application can individually choose their preferred training topics in advance from a list before being allocated to a group. The list of training topics is customizable and prepared beforehand by the facilitator to suit the workshop’s needs. This way, the extra complexity of coming up with a workshop-appropriate non-vague training topic is avoided.

Training variable cards and assignment

The web application preserves the concept of card-presented training variables since it was an appreciated feature in the physical version. The card categories and contents remain the same as presented earlier in Table 1. Nevertheless, we decide to adjust their color coding for higher contrast between the card’s text and background, based on colors used in charts to make data more distinguishable [25]. The training variables assignment is still random, and the possible outcomes are selected by the facilitator in advance depending on the workshop’s needs.

Training structure preparation

In the physical Train the Trainer activity, apart from the training condition cards and the persona sheet, the process of preparing a training structure appears to be unspecified. While necessary to leave participants room for personal expression and group brainstorming and discussion, we argue that offering no further guidelines on the group’s preparation, the workshop’s lengthiest phase, could make the experience feel daunting, thus limiting participant creativity and engagement. To address this issue in the web application, we turn to gamification. By adding roles and goals on top of the existing experience, we guide participants on their preparation through interactive tasks, providing them a foundation for further personal and group work. The “Further gamification” subsection discusses in detail these added gamification elements.

Group presentation

When a participants’ group present their work to the rest of the workshop, their audience needs to know their training topic and training variables. Taking advantage of the web environment, we can now display the presenting group’s information on each participant’s device to facilitate matters.

Workshop outcomes

The goal of workshops that employ the web application is the same as the original Train the Trainer activity: discuss, design, and deliver practical training structures. Since participants interact with their devices throughout the experience, the application keeps track of their work. Therefore, apart from experiencing the workshop’s activities, participants can save their workshop work digitally through the application.

3.2.2 Stages

Considering the structure of the physical Train the Trainer experience and our adjustments and additions to the format, we divide the web application into five main stages. Besides them, two additional pseudo-stages, one at the beginning of the workshop and another at the end, are included to outline the whole workshop procedure more clearly. The following list defines each stage and its contents in order:

0. **Workshop introduction.** At the beginning of the workshop, participants use the credentials shared by the facilitator to join the appropriate online workshop session from their devices.
1. **Topics & Roles.** Participants individually pick their preferred training topic(s) and role(s). Then, they join groups based on their choices.
2. **Training Conditions.** Each group is introduced to the four training conditions and is assigned a random one for each category.
3. **Preparation.** Goals are introduced, matching each participant's role, guiding them in preparing a training structure. Persona creation is a common goal for all participants.
4. **Unforeseen Circumstances.** An introduction to the two unforeseen circumstances follows. The group decides whether to pick them before or after their presentation. Just like the training conditions, the unforeseen circumstances assignment is random.
5. **Presentation.** Each group discusses their work with the rest of the workshop, one at a time. Participants not presenting can view the presenting group's information.
6. **Workshop conclusion.** At the end of the workshop, participants can keep a copy of their work, including personal and group details, their group's training variables, and their completed goals.

It is worth noting that a brief discussion took place with the creator to specify the unforeseen circumstances assignment options on stage 4. We examined three options:

- **Just before the group's presentation.** After preparation, give the group a minimal amount of time to adapt their training to the unforeseen circumstances cards.
- **During the group's presentation.** In the middle of presenting, the group picks the unforeseen circumstances and must adapt on the spot.
- **After the group's presentation.** Once the group has finished their training presentation, they have a few minutes to pick the unforeseen circumstances cards and discuss with the other groups what they would do differently.

The creator pointed out that it can work in all three ways, although not all are suited for every situation. Being the most disruptive of the three, we both agreed to remove the "During" option. Consequently, as is evident by the stage's description, the other two options remain, each suitable for different contexts. The option "Just before" benefits presentations that do not need to highlight the contents of a group's training structure to other participants, focusing on adapting to the unforeseen circumstances instead. Such situations show up when having very experienced trainers in the workshop or/and when everyone's presentation is about the same topic. On the contrary, the "After" option is appropriate for groups new to the training topic, as the audience can provide support and help by sharing their experiences.

3.2.3 Further gamification

The Train the Trainer web application features three additional, fundamental to its format, gamification elements: roles, goals, and a scoring system. In the following segments, we observe these elements one by one.

Roles

Since participants are (potential) trainers, five roles, highly relevant with training activities and workshops, are introduced: Organizer, Persona Manager, Venue Manager, Risk

Manager, and Trainer. Having different responsibilities and goals, described in the following segment, each group member contributes to the whole by focusing on different training perspectives, encouraging involvement from everyone. The roles are inspired by realistic training and workshop environments, aiming to reinforce the practicality of the participants' training structures.

Goals

The collective intention of all participants should continuously be the development of a workshop-relevant training structure. With that in mind, the web application introduces two types of goals: a primary goal that reminds participants of their role objective and a collection of sub-goals to help them reach that objective step by step. The main goals and some sub-goals examples for each role are presented in the list below:

- **Organizer.** This participant must shift their perspective to that of an organization that employed trainers, the participant's group in this instance, to prepare and deliver appropriate training. Considering their group's training topic and training variables, an Organizer ought to make up an organization profile, defining facilities, services, and resources that can be provided to the trainers while also determining the organization's goals of the training program.
- **Persona Manager.** The primary responsibility of the Persona Manager is to consider ways of connecting with the supposed audience before, during, and after the training program. Other important tasks include the arrangement of audience registration, the promotion of the event, and the collection of the audience's feedback.
- **Venue Manager.** The Venue Manager oversees all activities and use of the facilities in which the training program takes place. Within budget, they must provide plans and equipment to adequately accommodate the audience and arrange venue services depending on the type of training to enhance the audience's experience.
- **Risk Manager.** Outlining what could go wrong before, during, and after the training program and providing solutions is the leading concern of a Risk Manager. They map out potential scenarios to mitigate some possible risks that may appear in a live setting.
- **Trainer.** Trainers, who are the main component of any training program, need to shape clear, specified training objectives based on the autonomy the supposed host organization allows. They structure the training content according to the audience and training variables.

As can be observed, many sub-goals concern multiple roles, if not all. Anyone in the group can and should help accomplish any sub-goal since they are not role-restricted, promoting collaboration between group members. Additionally, participants should not be required to complete all goals and sub-goals, as they function as guidelines for preparing a training structure.

Being the most significant and transformative addition to the experience, we proposed our modifications to the creator and awaited their input and feedback, just like other format adjustments. The creator thought the roles and goals "reflect the reality" and are "well-developed" and recommended some role name changes for clarity. Thus, to better describe their goals and responsibilities, we renamed the former-labeled "Leader" and "Presenter" roles to the current "Organizer" and "Trainer" role names, respectively.

Score

Each sub-goal completion awards the participant with “Training Points” that improve their score and their group’s score. The higher the importance or/and challenge of a sub-goal, the higher the points it awards, indirectly revealing its priority hierarchy in preparing a training structure. Participants can view their current score and group score, along with a sub-goal completion percentage, tracking their preparation progress and development.

In general, roles, goals, and scores intend to direct participants into preparing practical training structures using a step-by-step approach, distributing diverse responsibilities across the group while also providing an engaging, enjoyable experience. On that premise, these gamifying elements should not obstruct the general purpose of a Train the Trainer workshop, which is to coach participants into learning a specific topic and enabling them to teach it to others. Participants should be free to judge themselves and decide how much time and effort they want to invest in the application’s gamification.

3.2.4 Contributions and challenges of the digital experience

The web application both contributes positively and presents challenges to the current state of the Train the Trainer activity. The following list demonstrates potential advantages of using the web application over the physical game, from both the participants’ and the facilitators’ perspectives:

- **Obtainability.** Accessible through the internet, the application eliminates the need to print cards or have a physical copy of the cards. Training variables can show up more than once across groups without needing multiple decks of cards. Training variable cards updates and additions are ubiquitous.
- **Interaction and engagement.** In the digital experience, participants approach their end goal of preparing a training structure by carrying out multiple, smaller, and more attainable goals. The group divides into different roles, and each group member addresses their role-specific tasks, contributing individually and uniquely to their group’s training preparation. Each task completion brings them closer to achieving their end goal, providing a sense of progression to the process.
- **Collaboration and productivity.** Since the web application features online workshop sessions, the workshop members are interconnected, supporting the grouping of participants with similar goals and the preparation and presentation stages. Facilitators better track participant and group progress, judging if they need further guidance and intervening appropriately. Similarly, participants have access to their group’s work as well as the presenting group’s information. The workshop session stores the participants’ works and thus allows participants to keep their work digitally for future reference.
- **Scalability.** The digital environment encourages implementing new utilities and functionalities to the experience, whenever and wherever deemed helpful. For example, by adding translations, participants could view the same workshop content in different languages, partially tackling language barriers.

On the other hand, the digital approach presents several challenges that we should discuss:

- **Distraction.** The digital version carries the risk of distracting its audience from working and communicating with each other. It should not replace group work and group discussion, subsequently not detracting from the learning process. At the same time, a bustling workshop makes it demanding for participants to focus on the application.

- **Technical issues.** Participants and facilitators require to use their devices repeatedly during the workshop, within online workshop sessions. So, the workshop's successful flow is contingent on the lack of technical issues, such as low device battery or internet disconnections. Additionally, access to technological resources and digital competence should not always be presumed.
- **Increased complexity.** Assuming that participants use the application for the first time, they need time to familiarize themselves with the application on top of being involved in the non-digital components of the workshop. Similarly, the facilitators need also to become acquainted with the application considering they have the additional task of preparing, coordinating, and observing the online workshops sessions.
- **Implementation.** Although this project focuses on the design aspect of the digital Train the Trainer experience, we should note that its implementation seems challenging. The application must support multiple active workshop sessions, and the experience must be synchronous for all workshop members.

3.3 User groups

Whether considering the physical or digital version, we identify three user groups involved in the Train the Trainer experience:

- **Players.** The participants who attend the Train the Trainer workshop. In groups, they prepare and present training structures built upon their appointed training topic and training variables. Their goal is to reinforce or/and acquire new trainer skills and knowledge to apply them in future training courses of their own. Prior training experience and appointed training topic knowledge can vary from novice to proficient. Given that it is frequently their choice to apply for and attend the workshop, they are motivated and cooperative during the workshop activities. They are the vast majority of the users of the Train the Trainer experience.
- **Facilitators.** Being responsible for the proper execution of the workshop, facilitators organize, consult, and assess the outcomes of the training session. They guide the players throughout the training activity while also managing the duration of each part of the workshop. Reasonably, a satisfactory level of training experience and knowledge is required. They can be either one or many per workshop.
- **Content Creators.** The people who update the content of the experience, such as adding, removing, or changing cards. If the workshop allows for flexibility, players and facilitators can also be perceived as content creators when modifying the training experience according to need and preference.

3.4 Prototypes

An essential phase of UX design is prototyping, which involves capturing previously developed ideas on static or dynamic, paper or digital models to gather user feedback, demonstrate strengths and weaknesses in design, evaluate usability and make appropriate adjustments at an early stage, allowing for an iterative design approach. Prototyping can be either low-fidelity, high-fidelity, or somewhere in between, as per the extent of details and functionalities. Since they are faster and easier to develop and make changes, low-fidelity prototypes are usually preferred during the initial prototyping stages, gradually shifting towards high-fidelity when the project's ideas and design become more and more polished. Our project follows this convention, creating and evaluating prototypes of varying fidelity, resolving design issues, and progressively increasing the level of detail and functionality with each consecutive iteration.

We managed to develop prototypes for one of our three defined user groups: the players. Naturally, as players are the majority of users and the target learning group of a Train the Trainer workshop, we focus on the player's user experience. We hope that the resultant player prototypes will aid in designing the prototypes this project did not cover, that is, facilitator and content creator prototypes, besides highlighting possible design strengths and weaknesses to allow for further refinement of player prototypes.

Following a mobile-first design, we develop prototypes for smartphone devices, specifically for portrait orientation. As smartphone display resolutions vary between devices and without loss of generality, the page dimension that we use for our prototypes is 360x740 pixels and is based on the display resolution of the smartphone Samsung Galaxy S9, sharing the same aspect ratio.

High-fidelity prototypes entail a degree of realism and responsiveness. For the prototyping process, we employ the prototyping software Axure RP Pro for its prototype interactivity, authenticity, and preview features, examined in the following subsection. Consequently, in the "Player prototypes" subsection, we present the final prototype iteration addressing both their interface and interactivity components plus comparing and contrasting them with some instances of earlier prototype iterations side-by-side, justifying the reasons behind design choices and modifications. The full interactive prototype developed is available at https://1343n8.axshare.com/.

3.4.1 Prototype interactivity, authenticity, and preview features

Axure offers a few prototype interactivity features which can be viewed in a web browser by generating HTML websites. The ability to upload and preview a password-protected project online in the cloud allows for interacting and testing directly from a smartphone device while also proves effective for sharing and showcasing the work to people of choice. Having a set of high-fidelity, dynamic prototypes seemingly indistinguishable from an actual web-based application enables testing with real users early on and helps identify even more user experience and usability issues, along with design problems, before implementing the actual application. In this subsection, we present the main features we utilized to develop interactive, realistic prototypes.

Events and actions

If specified, certain user-triggered events, like mouse and keyboard inputs, touch gestures, or a page load, can be detected by elements within a page or by that page itself to execute one or many actions in a sequential manner. Actions are responsible for dynamically browsing and adjusting a page's content or even triggering another event. Each action then has a variety of customizable options depending on its type and complexity. Without listing all of them, some of the more common actions used in the project include the "Open Link" action, which essentially is a page redirection, and the "Show/Hide" action to toggle an element's visibility.

Animation effects

Some actions allow for animation effects, meaning they have a visual impact on the screen when triggered by an event over a determined time. Two types of animation effects are available: visibility effects, for example, a fade-in or out animation, and movement effects that alter an element's position and orientation. Both types are especially beneficial for our project to illustrate smooth swipe animations, given its mobile-first approach. Other animation effect instances in the project include lightboxes, expanding and collapsing lists, and flipping or easing in and out elements.

Global variables

Global variables serve as a means of keeping and transferring information across a project, between pages. They can either have a starting default value or be empty, and the “Set Variable Value” action can dynamically assign a different value to them depending on the state of the application, which is stored indefinitely until another value overwrites it or until the HTML preview page is refreshed or closed by the user. In our project, global variables support enabling or disabling buttons based on the status of required fields or selections, monitoring goal progress, memorizing half-done and completed goal inputs, viewing and modifying submitted goals, and keeping track of selected items in a list.

Conditional logic

When an event is triggered, and if specified, an element can execute separate sets of actions and have different behavior depending on the state of the application by using conditional logic. Events can have one case using a single “if” or multiple using “if/else” chains. Every case has a condition that evaluates in “true” or “false” and may contain one or multiple conditional statements, with each one comparing two values in some way. The project uses conditional logic for enabling or disabling buttons based on the status of required fields or selections and primarily for modifying elements visually, such as selected and unselected item colors and shapes.

Dynamic panels

A dynamic panel keeps other elements in one or many “states” or, in other words, groups, and only one state can be visible at a time, which can be dynamically changed using the “Set Panel State” action. With the added capability of being swipeable and having a fixed position when required during browsing, they are used extensively in the project. This way, the application supports the swipe functionality and pinned headers.

Additionally, to showcase a single page’s micro-functionality, employing dynamic panels negates the need to create multiple similar-looking pages, avoiding unnecessary page redirections and page load times. However, as powerful as they are in building the immersion of an actual real web-based application, using them indicates that, during the prototyping phase, designers cannot view all the page’s content simultaneously without first browsing and finding all different functionalities hidden behind panels. In the awareness of the importance of prototype design readability and sustainability, we chose to utilize dynamic panels because they provide considerable authenticity and interactivity traits in our application.

User input

A few approaches exist to collect user input in Axure, including default library text fields and areas, checkboxes, radio buttons, sliders, droplists, and list boxes. Designers can also create other, more sophisticated, custom solutions to suit their needs with a combination of elements, events, and actions. Our project contains a mix of default and custom solutions to collect topic and role preferences, goal inputs, particularly regarding the persona’s creation, other workshop-related selections, and user feedback.

3.4.2 Player prototypes

Before presenting the player prototypes, we would like to discuss some general design and aesthetics choices evident throughout all or most prototype pages. From this point onwards, we refer to the Train the Trainer web application simply as “Train the Trainer” for brevity.

Given that the physical version of Train the Trainer does not have a logo, a search on the internet took place at the early stages of design to assist in finding or coming up with an

idea of a workshop-related logo. Instead of determining and using a logo, we settled on just having an image (henceforward, the Main image) illustrating people collaborating and planning at the top of the introductory and, later, the concluding page for purposes of intentions and appeal. To further suggest the objectives of the Train the Trainer application, the motto “Group up. Prepare. Present.” is conceived and displayed on the home page below the Main image.

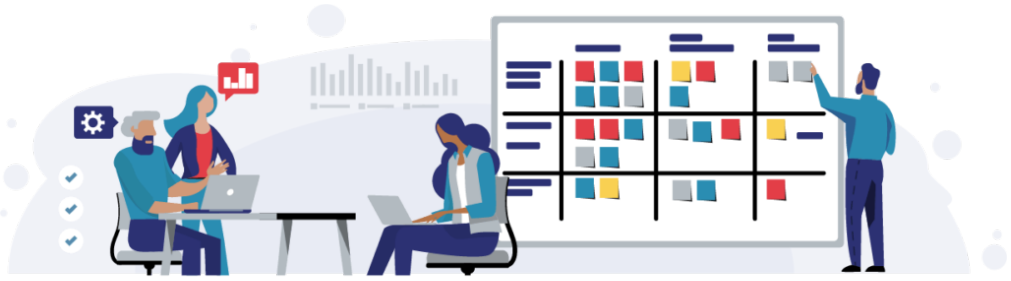

Figure 8: The Main image of Train the Trainer. Source: [26]

Determining and selecting a suitable color palette for the interface of Train the Trainer is crucial. A few color selections are influenced by the Main image, while others by general color conventions, replacing most shades of gray of early prototyping. Each color expresses different meanings regarding the application’s content, status, and functionality, staying consistent across pages. As seen in Figure 9, the primary color scheme of the prototypes consists of the following: a medium-dark shade of blue indicating interactive elements, selected options, or the current state of the application, a light shade of blue used as background to signify areas of interest, and a medium-light shade of green implying something has been finished or accomplished. Gray is still employed occasionally to denote disabled interactive or static elements, to provide subtle captions and user input hints.

Figure 9: The primary color scheme of Train the Trainer. Individual codes and summarized purposes for each color. Colors and their codes produced by the online tool Encycolorpedia [27]

Players participating in the workshop must follow a specific sequence of tasks based on the stage format we described earlier in the same-named subsection. Thus, the prototypes embrace the five main stages format, resulting in a sequential website structure design that navigates players through the process step by step, made apparent by a five-step progress bar visible on all related pages. Note that the prototypes include the two pseudo-stages, translating into the home and concluding prototype page correspondingly, but are excluded from the step progress bar because they are too short and obvious.

Except mapping out and splitting the whole process into smaller tasks, a step progress bar displays the user’s current step, the completed steps, and the steps left to complete. A step progress bar provides feedback to the user about their status, makes the process less daunting and more apparent as it is split into smaller, manageable tasks, increasing

overall user enthusiasm to continue participating actively. Although some step progress bars allow backtracking, this is not our case, granted that the Train the Trainer workshop group activities tend to follow a linear and predetermined order where participants must be on the same stage.

Mobile application or not, the step progress bar design should be clear and concise while also conveying all the essential information. Figure 10 shows an early design of a step progress bar and the final one. Both have similar configurations, with circular numbered stages and labels with the stage's names below. The earlier version, while functional, lacks clarity, as current, past, and future steps are hard to distinguish from each other. On the contrary, the final version utilizes color-coding in shapes and fonts, following the main color scheme of Train the Trainer, highlighting the current stage, marking completed ones off, and focusing less on later stages, while all remain readable.

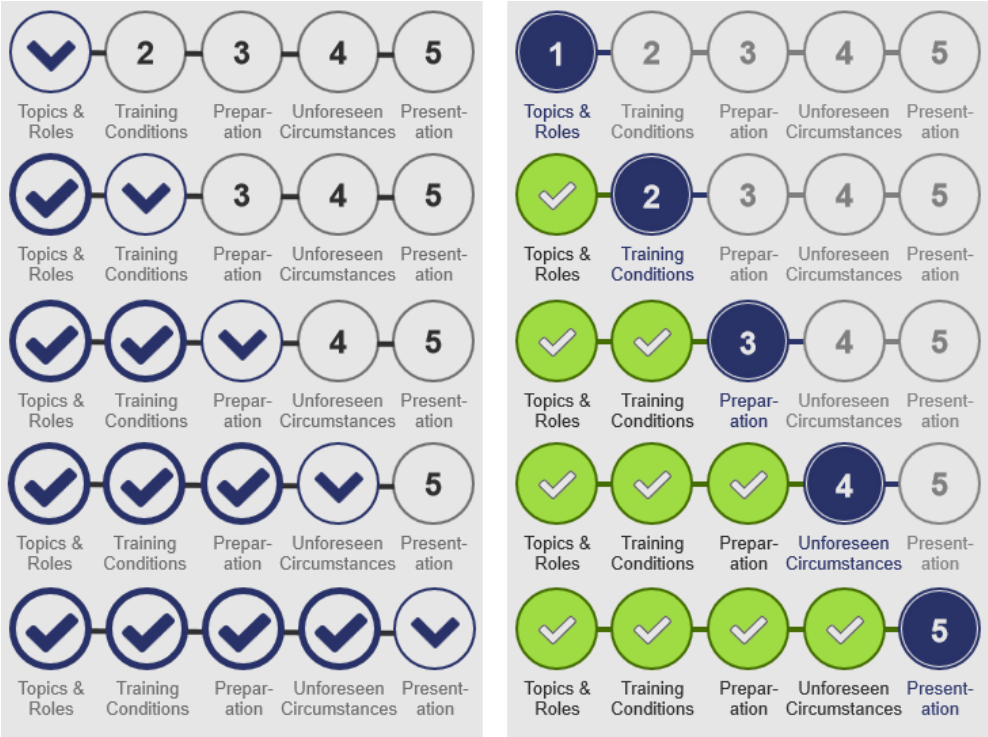

Figure 10: An earlier iteration of the step progress bar design for each stage (left) and the final one (right)

Interactive interface elements should look interactive. Similarly, non-interactive interface elements should not look like interactive ones. While helpful, color-coding is often not alone sufficient when needing to distinguish interactive from non-interactive interface elements. In Figure 11, we see a Train the Trainer button in two different states, disabled and enabled. Aside from color differences, the enabled button subtly casts a blurred drop shadow to add depth and make it stick out. The drop shadow effect is extensively used throughout the prototypes to signify pressable buttons, cards, and other elements.

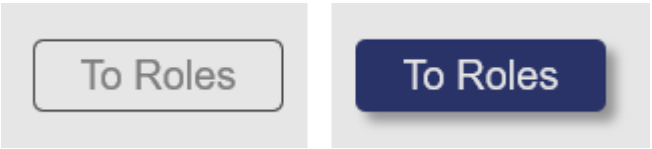

Figure 11: A Train the Trainer button when disabled (left) and enabled (right)

Notice that the button presented has rounded corners. Although user interface design follows different trends throughout the years, it is largely accepted that rounded corners help to tell apart interactive and non-interactive elements. Furthermore, in addition to

looking more visually pleasing, rounded corners are considered to indicate something safe and friendly, while sharp corners indicate something harmful [28].

Choosing proper wording and terms in our interface is, too, an important task. A button label, for example, should explain what is going to happen after pressing the button, prompting action simply and concisely [29]. Following this practice, early prototype buttons labeled “Continue” are replaced to eliminate vagueness and player confusion. Wording consistency is an additional factor. For instance, there are many ways to display information to users using one of the wording options *your*, *my*, or neither, yet, earlier interface versions mistakenly use both *your* and *my* wordings interchangeably across pages. Whereas we do not propose that any above option is better than the other in this project, we solely adopt the wording *your* for consistency.

Speaking of words and consistency, we use a single typeface across all pages – Arial. Hierarchy and different font sizes, colors, and typestyles help achieve different meanings and priorities between text.

Especially since the Train the Trainer application targets smartphone users, it must use large enough font sizes to ensure readability. We settled on having a minimum font size of 13px specifically for secondary and tertiary text, with form control, paragraph, and title text being larger-sized.

Due to the limited screen size of smartphones, having content below the fold in a mobile application is inevitable, meaning that only part of the whole content is visible on page load and that users must scroll down to view all content. For that reason, there should be some visual cue that there is content below the fold. The indicator we use in Train the Trainer, as seen in Figure 12, is a vertical background rounded rectangle. The rectangle includes all content, so in the case of having content below the fold, the user cannot see the rectangle’s bottom edges right away, hinting to them that there is additional content lying below the fold and directing them to scroll down to view it.

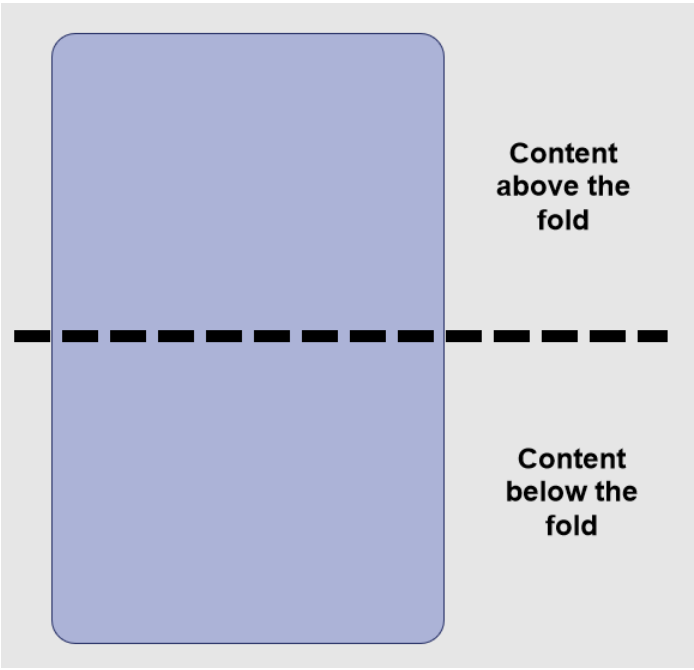

Figure 12: Handling below the fold content with a background visual cue in Train the Trainer

Each page in Train the Trainer has a specific, consistently persistent structure. Starting from the top of a page leading towards the bottom, these are its main components: a sticky header, the step progress bar if the player is in one of the five main stages or the

Main image during pseudo-stages, the main content meaning titles, possibly secondary and tertiary texts, and background rectangles that include all content, and a footer.

Finally, before presenting the prototypes of each stage, we discuss a few general matters of Train the Trainer that we choose to overlook or workaround because we consider their current implementation nonessential, having little to no impact on the effectiveness evaluation of the design's user experience. Modeling and handling technical issues that may appear during a workshop, like internet disconnections or device faults, and preparing related user interfaces when such problems occur, do not fall within this project's scope. Furthermore, we opt for predetermined user group assignment and autonomous stage progression since it is unfeasible to have multiple user sessions affecting one another during prototype preview to simulate a working grouping system or facilitator stage duration control. Besides group assignment, training topic, role, and training variable assignment outcomes are also determined in advance regardless of chosen training topic and role preferences to avoid developing identical content and interface elements for each available option. Consequently, for demonstration purposes, all users previewing the prototypes have the same predetermined "Open Access" training topic, "Organizer" role, "Number 4" artificial group, and outcomes during training variables assignment. Further, more specific matters of this sort are noted in the segments to come.

Stage 0: Workshop introduction

While the home page concerns all possible users of Train the Trainer, our primary objective is to provide a simple, fast way for players to connect to the application at the beginning of a workshop. In earlier versions, players had to go through a much more cumbersome process, a three-step process with modal dialogs to choose between playing as a guest or with an account and inserting credentials. For this reason, the application does not utilize user accounts, and all players are treated as guests, now needing only a facilitator-provided code and nickname to connect with a single step.

There are two text fields for players to type in their facilitator-provided credentials, after which they press the "Get Started" button to join in. For demonstration purposes, the prototypes do not provide a validation system to check the given code and nickname combination.

For those unfamiliar with the Train the Trainer application, we provide a help link that reveals a lightbox, explaining basic concepts about the application. The lightbox can be closed by either pressing the "X" icon or the shadow outside of it.

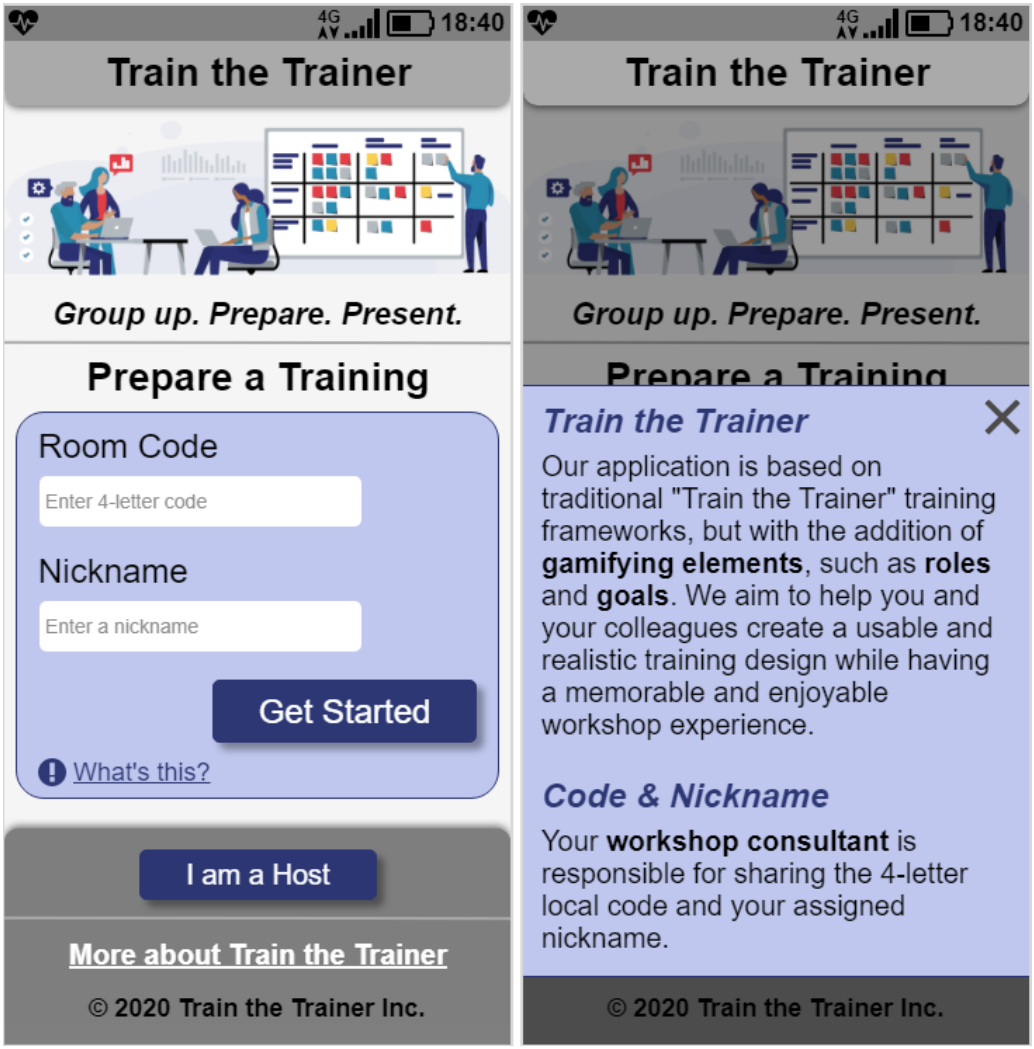

Figure 13: Prototype of the home page in its default state (left) and after pressing the "What's this?" help link (right)

Stage 1: Topics & Roles

At the start of every stage, an overview informs the player what they will do during it and their available facilitator-determined time.

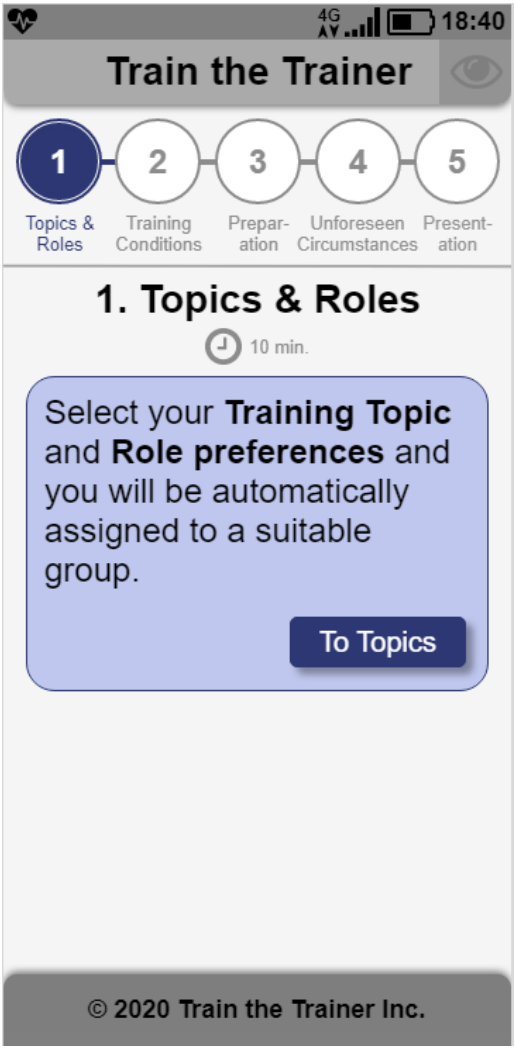

Figure 14: Prototype of the "Topic & Roles" stage overview

After pressing the "To Topics" button, the next page requires the player to choose one or many training topics of preference, one of which they will prepare a training program around.

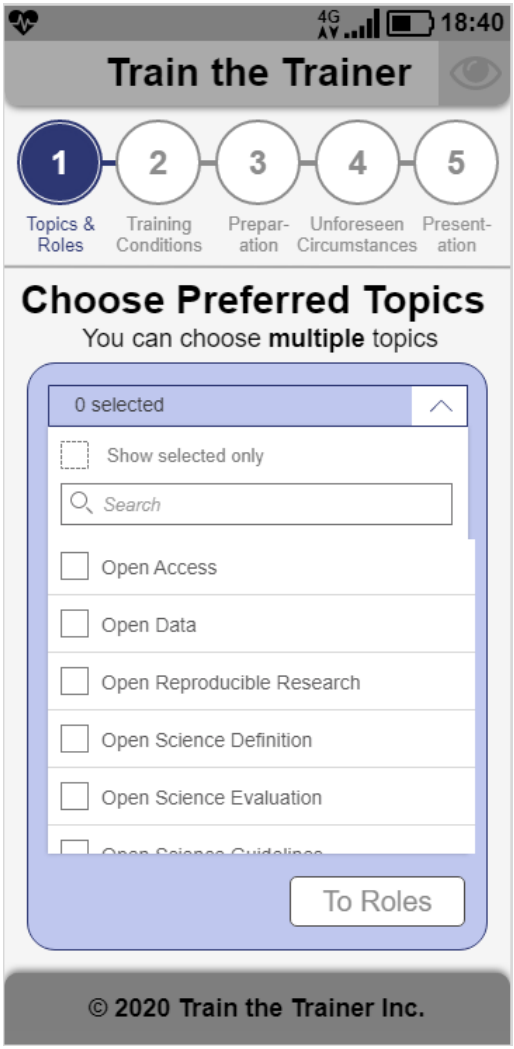

Figure 15: Prototype of the training topic preference selection

A scrollable, multi-select dropdown list holds the available training topics, with checkboxes determining selected and non-selected ones. The list also includes some filtering utilities, a “Show selected only” checkbox that allows viewing all selected items from the list, if any, and a search bar to look for specific training topics. We utilize a modified version of a list created and provided by a user from the Axure Community [30]. For demonstrating, the list contains only training topics related to Open Science, and in other cases, the facilitator is responsible for defining the list with custom workshop-related training topics.

When at least one training topic is selected, the player can press the “To Roles” button to continue to the role preference selection page, where they must choose one or many preferred roles they wish to have in a group.

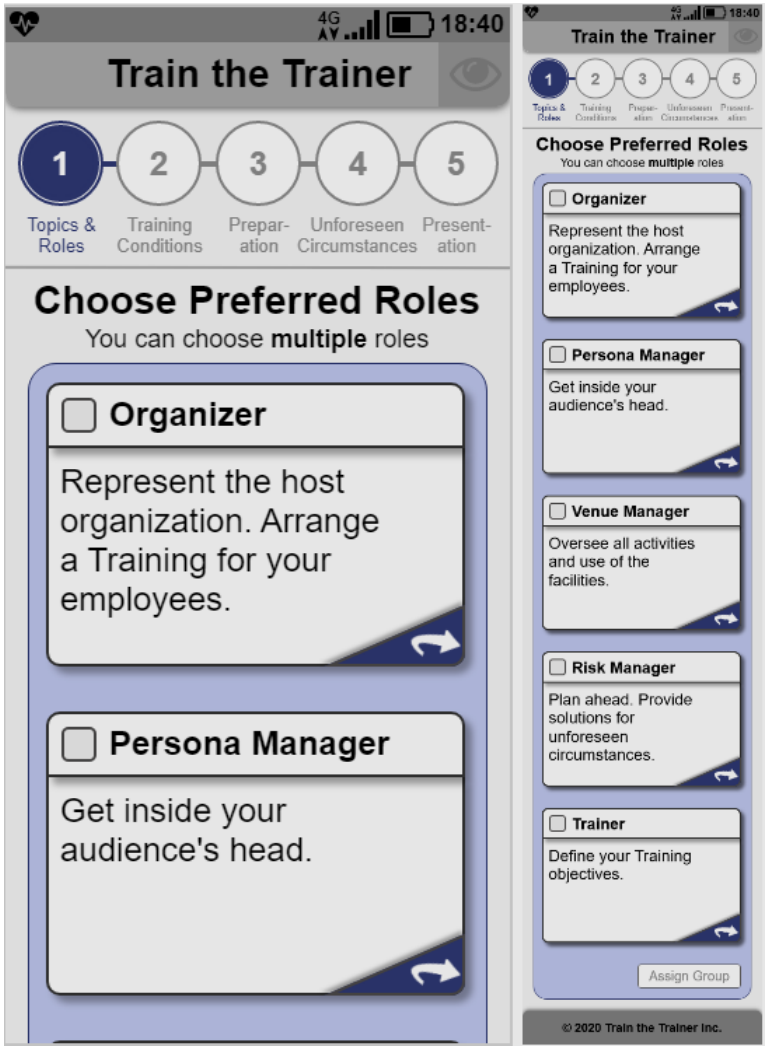

Figure 16: Prototype of the role preference selection, the part above the fold (left), and the entire page scaled down (right)

Each one of the five Train the Trainer roles has its double-sided card. On the front, the card contains the role title and its primary goal, and on the back, a short, representative set of tasks related to the role. Players can switch between the front and back by pressing the arrow on the bottom right of the card, triggering a flip animation. To select a role, players must press anywhere on the front side of the card, and the card changes visually to indicate their selection. Similarly, they can deselect a card.

In Figure 17, we present various design iterations of the role card, in all their states, leading to the current design. Apart from becoming more visually appealing, the current card groups its information more clearly and uses larger font sizes.

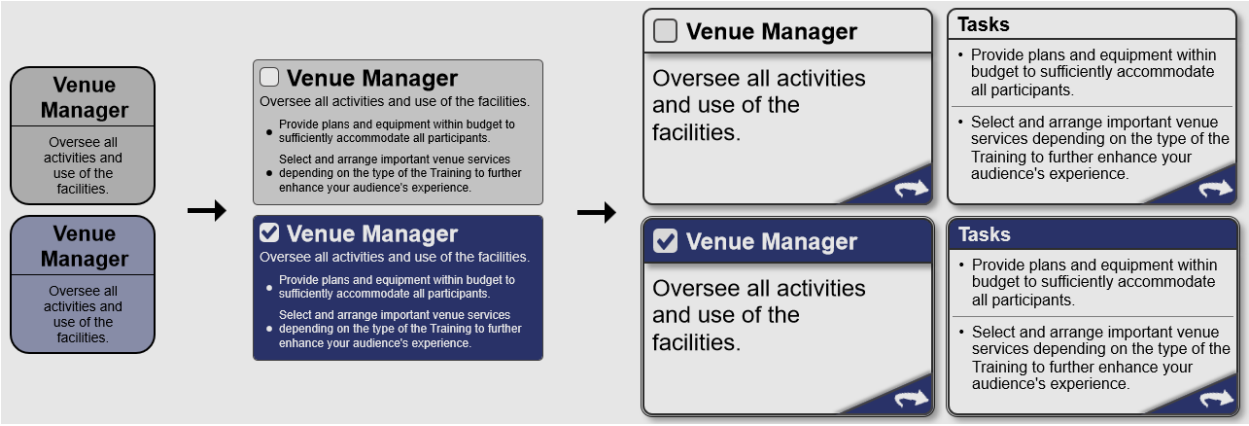

Figure 17: Progress on the role card design, transitioning from earlier design iterations (left and middle) to the current one (right)

Once at least one role is selected, the player may press the “Assign Group” button to confirm their preferences, waiting until they are assigned to a group and advancing to the next page, a process executed instantly for testing purposes. The following page is the last part of the “Topic & Roles” stage and informs the player of their assigned training topic, role, and group, by introducing them to their Training Overview.

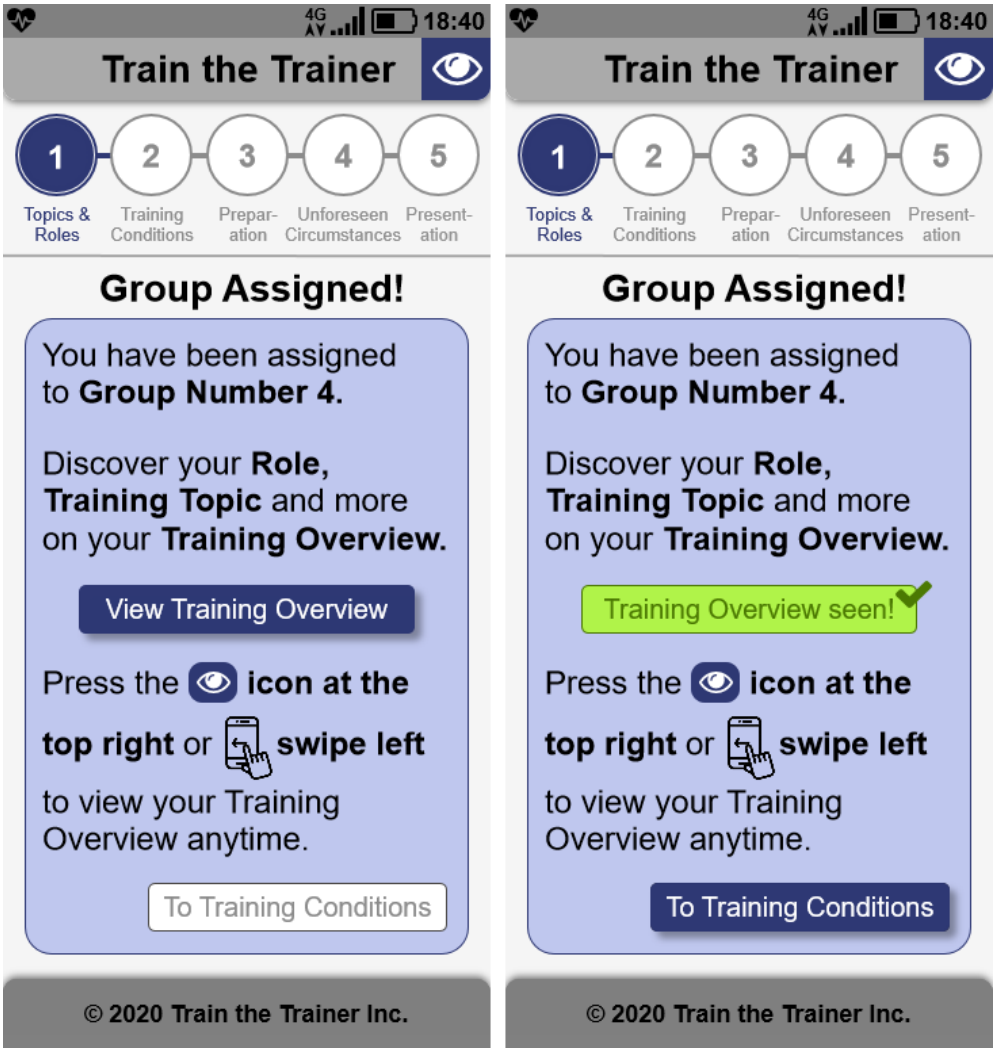

Figure 18: Prototype of the player’s Training Overview introduction page in its default state (left) and after viewing the training overview (right)

Besides the assigned role, group, and training topic, the player’s Training Overview contains the group’s training variables. Until each corresponding training variable

assignment occurs, grayed-out locks take their place. As advised, the player can access their Training Overview during the whole workshop with or without gestures, either by pressing the eye icon at the top right or by swiping left, triggering a slide transition. Similarly, exiting the Training Overview can be done either by pressing the “X” icon at the top left, by swiping right, or by pressing the “Back” button at the bottom of the Training Overview, again triggering a slide transition. To continue, players must view their Training Overview at least once. By exception, the page offers another way to view the Training Overview on this specific instance, a “View Training Overview” button, aiming to familiarize players with their Training Overview. Note that the Training Overview can be accessed at any stage of Train the Trainer from now on, and the slide transition intends to indicate that it is not a standalone page, so players should not regard it as one.

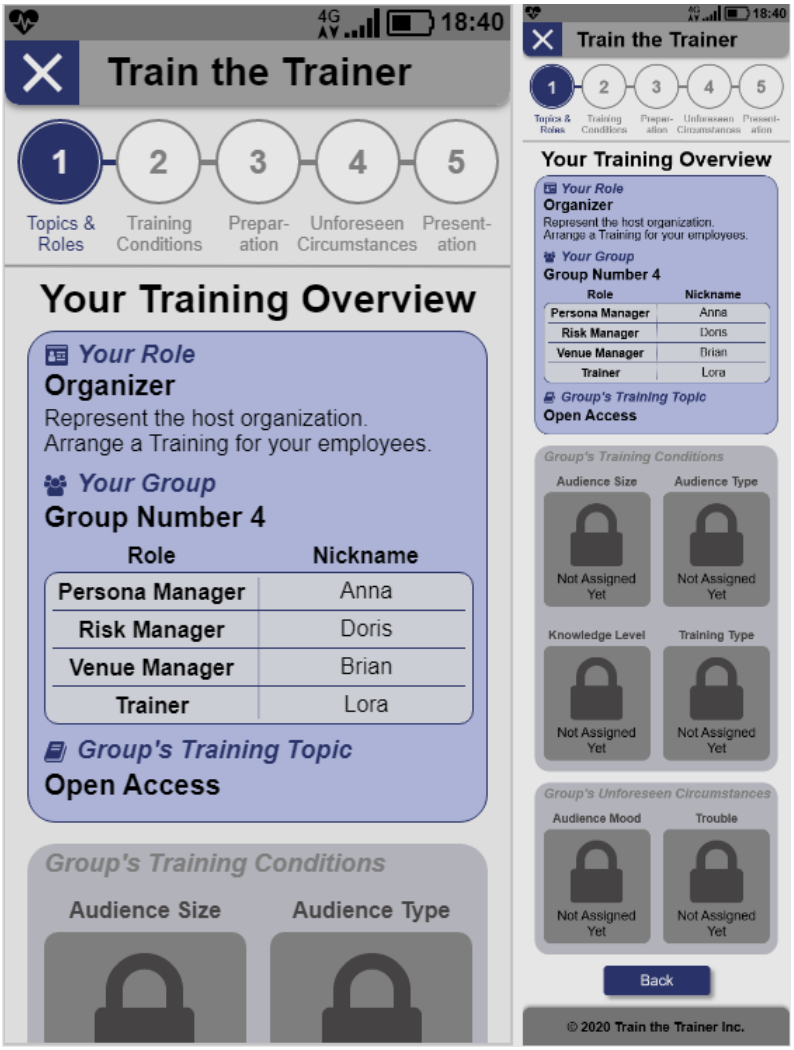

Figure 19: Prototype of the player’s Training Overview, the part above the fold (left), and the entire page scaled down (right)

Comparing the current Training Overview interface with earlier iterations in Figure 20, we notice improvements in wordings, font sizes, and aesthetics. Another significant change is the size of training variables, shifting from small to large and from four-per-row to two-per-row to increase readability.

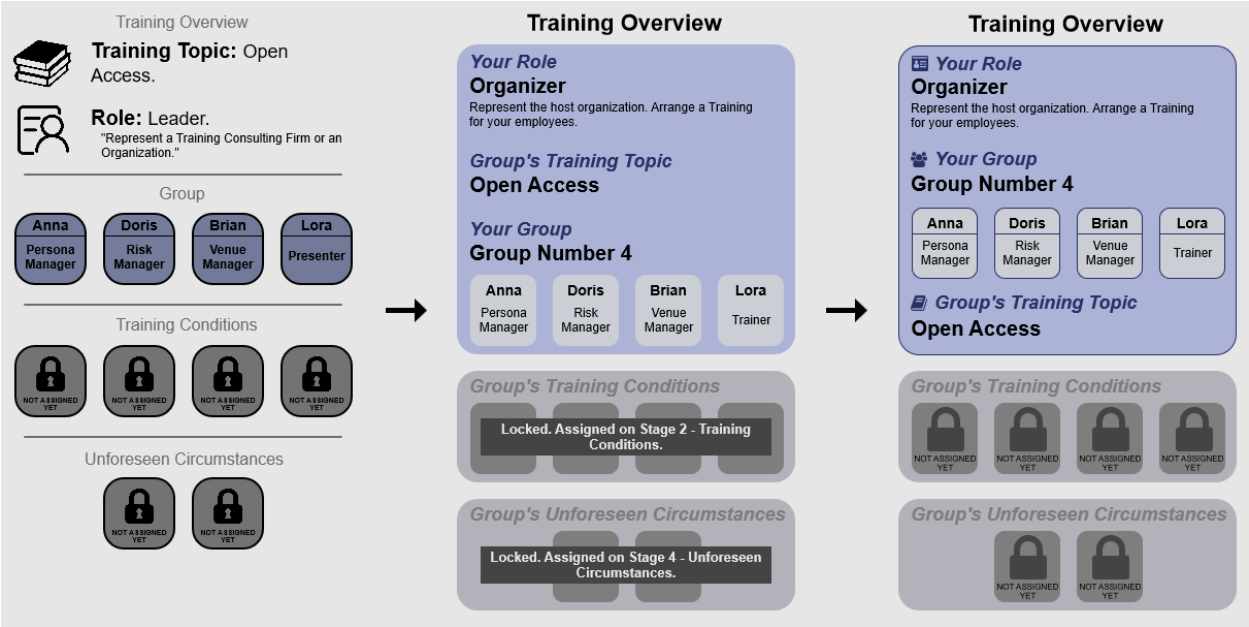

Figure 20: Earlier iterations of the player's Training Overview interface

An additional modification takes place concerning the Training Overview access icon. In Figure 21, we observe a set of arrow icons used in earlier prototypes. Having no colored background and being generic, ambiguous icons, they fail to be noticeable and recognizable. On the other hand, adding color increases discoverability, and establishing the eye icon for accessing the Training Overview and the “X” icon for exiting better conveys their meaning, increasing the chances of users interpreting them correctly because they have seen and used similar icons for similar purposes.

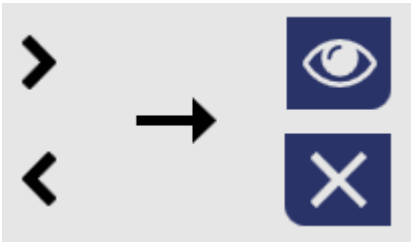

Figure 21: Progress on the Training Overview icon design, transitioning from an earlier iteration (left) to the current one (right)

Upon viewing their Training Overview and finding their group, players can continue to the next stage by pressing the “To Training Conditions” button.

Stage 2: Training Conditions

At this stage, the overview introduces the four card-illustrated training conditions: audience size, audience type, knowledge level, and training type. The page demonstrates the card’s format, consisting of an icon on the top and a label on the bottom, and establishes the colors used for each training condition card. As previously mentioned, we apply a different card color coding than the one used in the physical version of Train the Trainer for readability purposes, based on data chart colors [25].

Figure 22: Prototype of the "Training Conditions" stage overview

As the player continues to the training condition assignment page, they notice that each category has its horizontal "spin wheel" responsible for randomly assigning training conditions from a predetermined set of possible outcomes, a process illustrated in Figure 23. Pressing the "Spin!" button vanishes itself and the "Possible Outcomes" label, triggering a seven-second slide animation during which the spin wheel cycles through all available possible outcomes of a category until it gradually stops and lands on a card. After landing on the card, the spin wheel visually clarifies the successful assignment of that specific category, blurring out non-assigned cards and updating the player's Training Overview in real-time.

Figure 23: Prototype of the training conditions assignment "spin wheel" before the spin (left), during the spin (middle), and after landing on a card (right)

All four training condition assignments follow the same process, and the player can spin multiple wheels in parallel. For demonstration, each category only has three different possible outcomes, and there is no option for changing or switching assigned training condition cards. The player must spin all wheels and wait for all assignments to be allowed to continue to the next page.

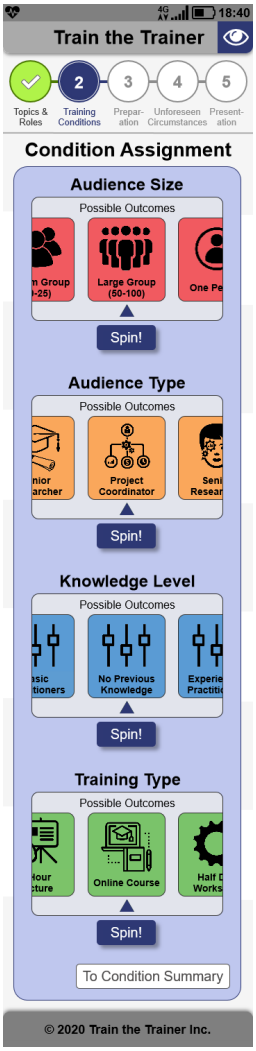

Figure 24: Prototype of the entire training condition assignment page scaled down

The next and final page of Stage 2 informs players that their Training Overview keeps track of their group's assigned training conditions too, and optionally, suggests they view it. Apart from the introduced ways to access their Training Overview, players may press the provided link, which takes them to their Training Overview, automatically scrolling down to the training condition fields. Lastly, the page reminds players to consider their assigned training conditions before starting preparation.

Figure 25: Prototype of the training conditions summary page (left) and the updated training condition fields on the player's Training Overview (right)

Stage 3: Preparation

The "Preparation" stage overview introduces the player to goals that are dependent on the player's role. The page suggests the player address their goals mainly for guiding purposes, as progressively developing an appropriate training structure with their group on time is the foremost, sought-after goal.

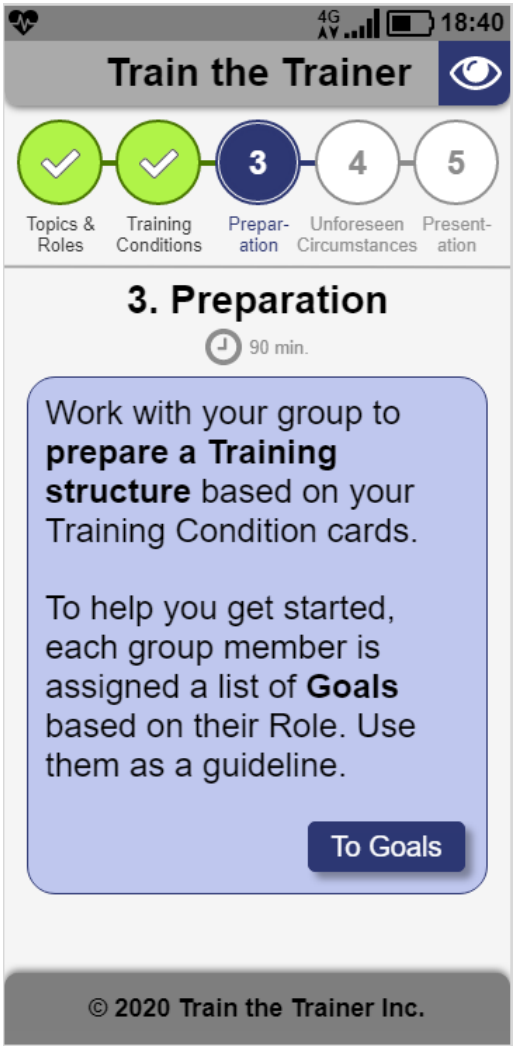

Figure 26: Prototype of the "Preparation" stage overview

Proceeding, the next page involves the player's goals and has two main parts. The upper part keeps track of the completion percentage of the player's and their group's goals using progress circles plus the player's and their group's Training Points measuring their score. Each goal completion triggers an appropriate update on both fields. Since there no other players during the prototype preview, only the previewer contributes to the group's score on this testing period.

The lower part of the page consists of the player's goal cards. Each card contains the goal's title, a short description, associated roles, and the Training Points reward. Pressing anywhere on a card takes the player to the corresponding goal page. The card visually changes to indicate the goal's completion, and an additional interactive "View" link appears on the card, allowing players to revisit and edit it if they wish.

The player may approach their goals in any order. The application tracks the player's progress in real-time, even when the player leaves their goals half-completed. For demonstrating, we provide just two functional goals: a "Set a Budget" goal concerning Organizers and the essential "Create Participant Persona" goal concerning each group member individually.

After completing all goals, a special lightbox appears on the screen congratulating the player and suggesting they help their group members or review their completed goals. In typical circumstances, the player would have to await the facilitator to trigger the next stage when the preparation time is over, a procedure we avoid by allowing the prototype previewer to advance to the next stage independently and instantly for testing purposes.

We provide a button and an appropriate description to support such functionality, deliberately using unusual visuals that do not match the interface scheme of Train the Trainer to evade previewers mistakenly considering it part of the intended interface design.

Figure 27: Prototype of the goals page in its default state (left), after completing one goal (middle), and after finishing all two goals (right)

Goals need a distinctive interface that is consistent with the rest of the application. Figure 28 contrasts an earlier design iteration of the “Set a Budget” goal with the current one. The former outlines the desired interface but does not use a background rectangle for its main content and obscures one main interface component, the footer, making it inconsistent with other pages. Apart from making the options and their icons clearer, the latter explicitly establishes the goal’s interface components, consistent with and lying in between the application’s main interface components. More specifically, the established goal interface includes, from top to bottom, the following three elements: the goal’s information, including title, description, associated roles, and score, the goal’s main content following the background rectangle pattern, and the goal’s available navigation and control options, always providing a “Back to Goals” button that returns players to the goals page regardless of the goal’s state and a “Submit” button that marks the goal as completed and returns players to the goals page.

The “Set a Budget” goal requests the player to theorize their available budget for the training, offering four card-shaped options: low, which is the default option, mid, high, and custom. The options use radio buttons to indicate they are mutually exclusive and that the player can select exactly one at any given time by pressing anywhere on the card.

Figure 28: Earlier prototype of the "Set a Budget" goal (left) and the current one (right)

The second goal, the "Create Participant Persona" goal, has considerably more content than the first. With the addition of new fields and structure, influenced by an online persona creation tool [31], it is an enhanced version of the current physical persona sheet. To avoid player discouragement while creating their persona with this expanded new version, we organize and split the persona creation task into five categorized steps, followed by an overview of the created persona:

- **Profile.** Name, Age, Personality, Disabilities / Health Issues.
- **Education & Occupation.** Education, Occupation, Job Responsibilities.
- **Skills.** Job Experience, Training Topic Knowledge, Training Experience, Technology Knowledge.
- **Challenges & Frustrations.**
- **Motivation & Goals.** Key Motivators, Goals in one sentence.

Input fields are vertically stacked, meaning that we arrange all inputs and labels on top of each other. On text fields, placeholder text hints at the expected player input by providing an example. Throughout these steps, we try to minimize the use of text fields for mobile user-friendliness by providing easy-to-pick preset suggestions on some instances and offering alternate user input fields, including sliders, cards, a dropdown list, and checkboxes. Some fields are required, like the name and age of the persona, indicated by a label in bold accompanied by an asterisk, while others are optional.

Note that the persona creation goal has additional navigation options since it consists of multiple steps. Circular arrow buttons enable players to go a step backward or forward if there is a previous or next step. Aside from tracking the current persona creation step, a set of interactive dots allows immediately visiting any other persona creation step by pressing the appropriate one. The “Persona Overview” button is initially disabled to encourage players to explore every step of the persona creation. Upon reaching the fifth and final step, players can press the now-enabled button to review their persona. Once enabled, the “Persona Overview” button stays enabled at all persona creation steps to assist in future quick revision of individual segments, if needed.

Figure 29: Prototypes of steps one, two, and three of the “Create Participant Persona” goal. The “Profile” step (left), the “Education & Occupation” step (middle), and the “Skills” step (right)

Figure 30: Prototypes of steps four and five of the "Create Participant Persona" goal. The "Challenges & Frustrations" step (left) and the "Motivation & Goals" step (right)

The overview page of the created persona gathers all details of each step in collapsible sections, one for each step, along with a supplementary, self-explanatory "Extra Notes" section. Pressing a section's title expands or collapses its content, triggering a short animation. The "+" and "-" icons placed at the front of each section's title indicate that, when pressed, an expand or collapse action will trigger correspondingly. By default, the "Profile" and "Extra Notes" sections get expanded on page load, and the rest remain collapsed until pressed.

Apart from the "Skills" section, we depict all section details using text, and in the case of non-filled fields, we use a double dash to indicate they are empty. Since the "Skills" section only has sliders, the overview portrays them with appropriately filled bars.

All sections based on persona creation steps include an "Edit Category" link. Pressing a section's link takes the player to the appropriate persona creation step, allowing them to make changes if they wish. Whenever the player feels ready, they can press the "Submit" button to complete their goal. If a player wants to revisit the completed "Create Participant Persona" goal, pressing the "View" link on the goal card instantly takes them to the overview page.

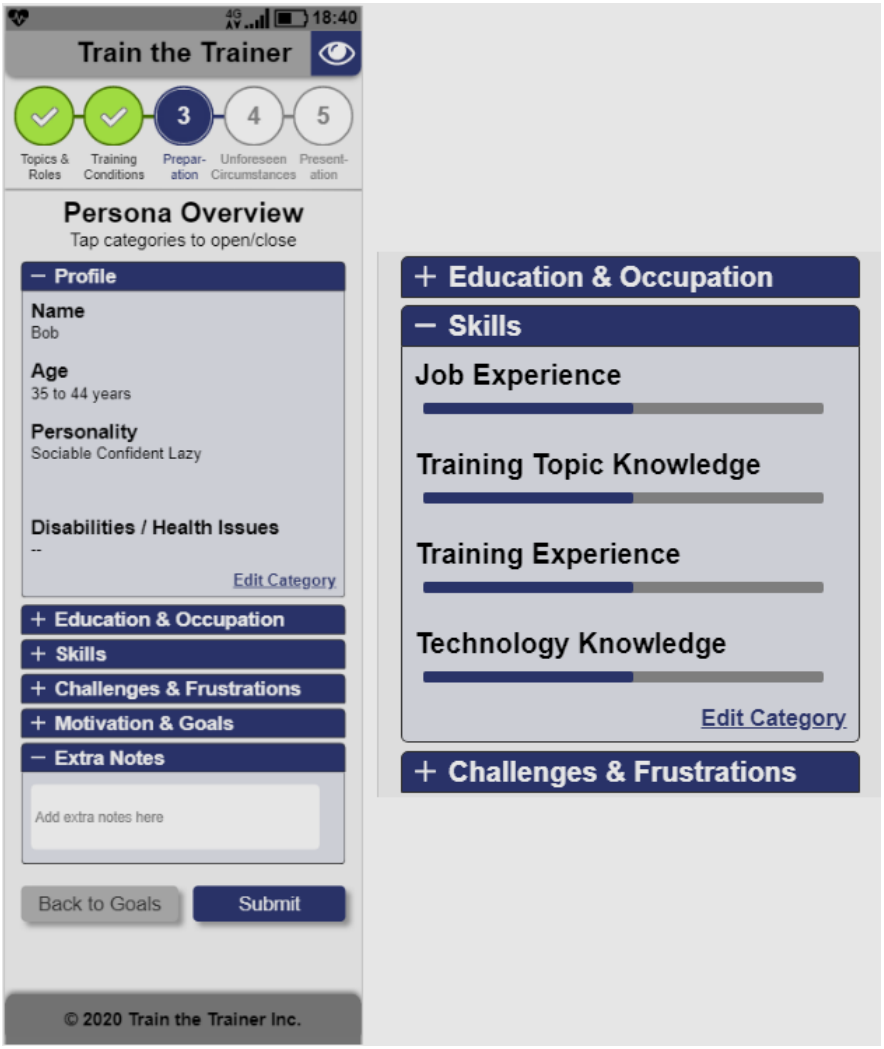

Figure 31: Prototype of the persona overview of the "Create Participant Persona" goal in its default state (left) and the expanded "Skills" section scaled up (right)

As previously mentioned, for testing purposes, the previewer can independently continue to the next stage after completing all goals. More specifically, after pressing the "Demo - Access Facilitator's screen" button, the one displayed in Figure 27, the previewer takes control of an improvised mockup of the facilitator's screen. Once again, the mockup's visuals intentionally do not match the interface scheme of Train the Trainer as it is not part of the player prototypes and only serves one purpose: to provide a way for the previewer to advance to the next stage. Pressing the single existing button in the facilitator's mockup screen, as shown in Figure 32, takes the previewer to the next stage's overview.

Figure 32: An improvised mockup of the facilitator's screen used exclusively for demonstration purposes to allow previewers to autonomously transition from the "Preparation" stage to the "Unforeseen Circumstances" stage

Stage 4: Unforeseen Circumstances

Along the same lines as the "Training Conditions" stage, this stage introduces the remaining two card-illustrated training variables, the unforeseen circumstances, together with the format used, identical to the training condition cards, and the colors used for each card, appropriately adjusted for readability purposes determined by colors used in charts [25]. The two unforeseen circumstances are audience mood and trouble.

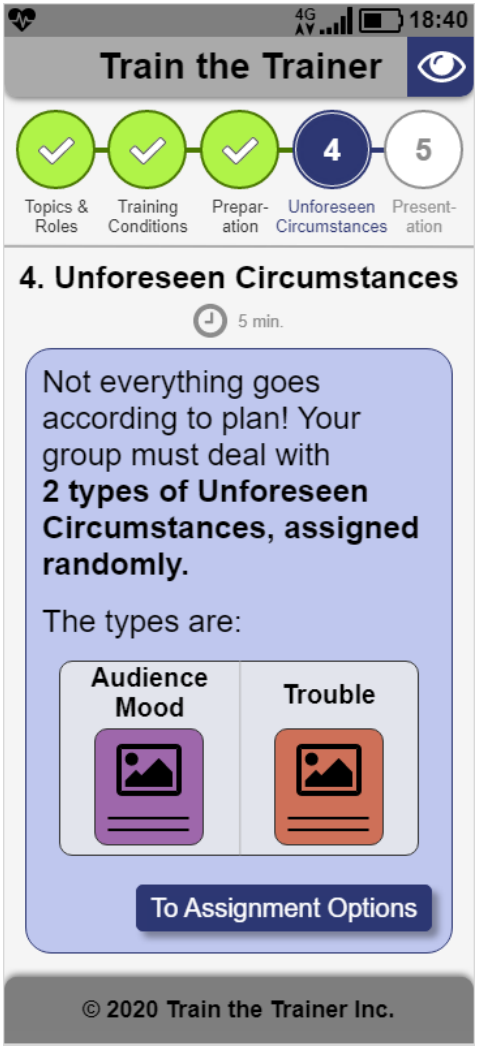

Figure 33: Prototype of the "Unforeseen Circumstances" stage overview

On the next page, before setting the assignment in motion, the player's group must consider and choose their preferred moment of the card assignment. As discussed in the "Stages" subsection, we settle on and provide two options: having the card assignment take place right after the group's presentation or right now. Each option serves a different purpose, addressing contrasting workshop arrangements regarding participant's expertise, audience feedback, and training topic variety. On page load, the "Right After Presentation" is presented as the default and recommended option because it is less prohibitive and allows for increased audience interaction. The group may select just one of the two options, implied by radio buttons, by pressing anywhere on an option's column.

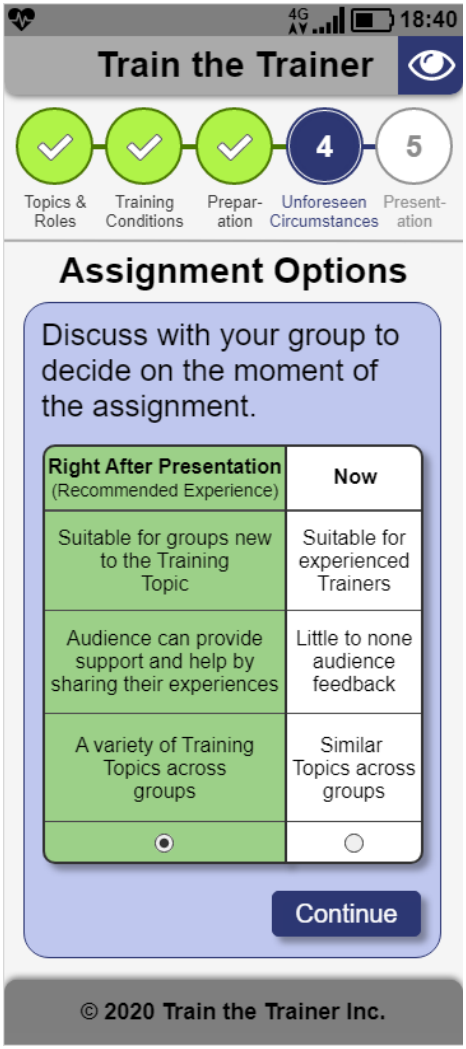

Figure 34: Prototype of the unforeseen circumstances assignment options

For the sake of exhibition, we assume the previewer is responsible for selecting an option for their artificial group, and they decide to pick the “Now” option, meaning they continue to the unforeseen circumstances card assignment.

The unforeseen circumstances assignment page is identical to the training condition assignment page, with the only difference being there are now two training variables instead of four. We use the same spin wheels for each of the two categories, having the same functionality as the one previously illustrated in Figure 23. Once again, three different possible outcomes are available, we provide no option for altering the assigned cards, and players may advance after spinning all categories.

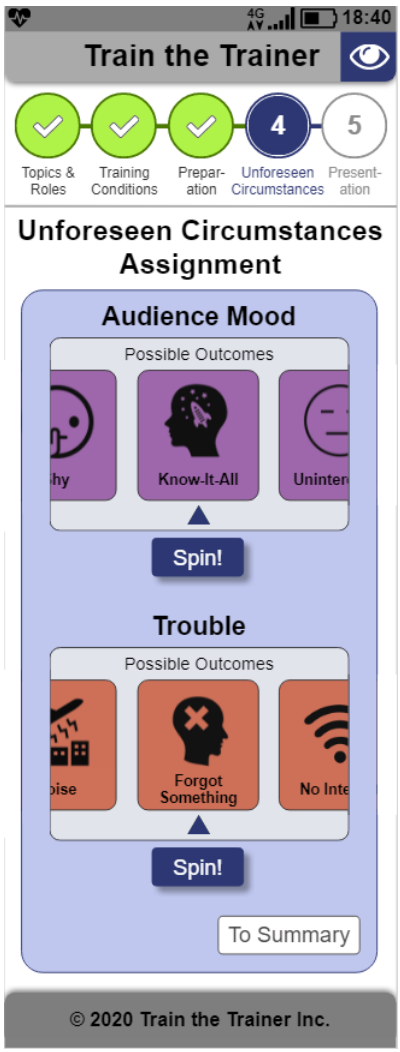

Figure 35: Prototype of the unforeseen circumstances assignment page

The unforeseen circumstances summary page is also similar to the one in the “Training Conditions” stage, recommending players to view their updated Training Overview fields by either using the introduced Training Overview access methods or pressing the relevant link. The link takes players to their Training Overview and appropriately scrolls down to the unforeseen circumstances fields. Pressing the “To Presentation” button advances players to the fifth and final main stage of Train the Trainer.

Figure 36: Prototype of the unforeseen circumstances summary page (left) and the updated unforeseen circumstances fields on the player's Training Overview (right)

Stage 5: Presentation

In the "Presentation" stage overview, we advise players that they need not deliver actual training. Players should present their training structure's main points to other groups within a set time frame while suitably adapting to their unforeseen circumstances and possibly interacting with their audience, one group at a time.

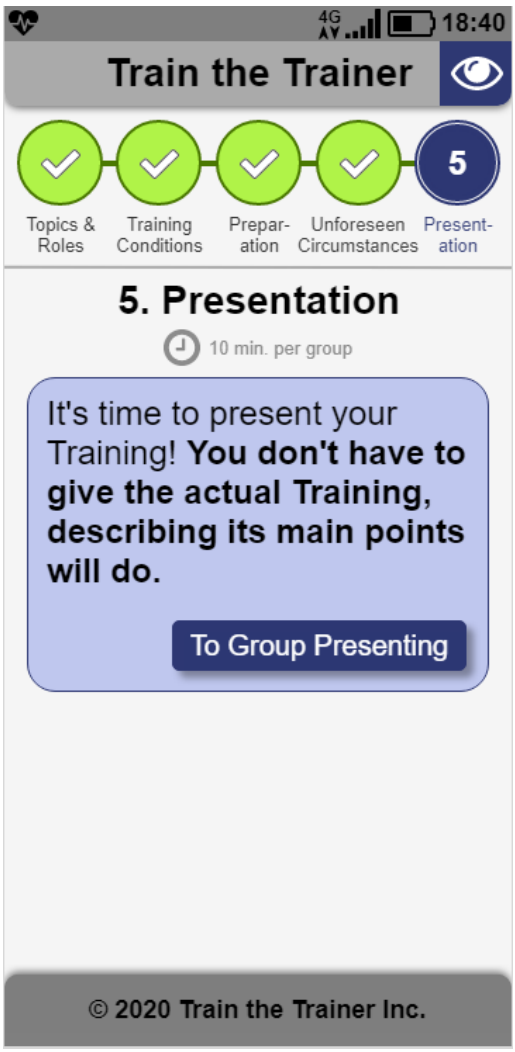

Figure 37: Prototype of the "Presentation" stage overview

Advancing to the following page, players can view the training details of the group currently presenting, including the group number and members, the training topic, and the training variables of the presenting group. When a group completes their presentation, the facilitator is responsible for appointing the next presenting group, automatically updating the presenting group information accordingly. Typically, the process would continue until all groups have presented their work, after which the facilitator would conclude the workshop, relocating all players to a workshop conclusion page.

Demonstrating the page's interface, we display a fabricated group's information. To enable the prototype previewer to view the workshop conclusion page by themselves, we provide a button identical to the one in the "Preparation" stage, previously displayed in Figure 27, with the same deliberate unfamiliar visuals to avoid mistaking it for a component of the intended Train the Trainer interface. The button is at the bottom of the page.

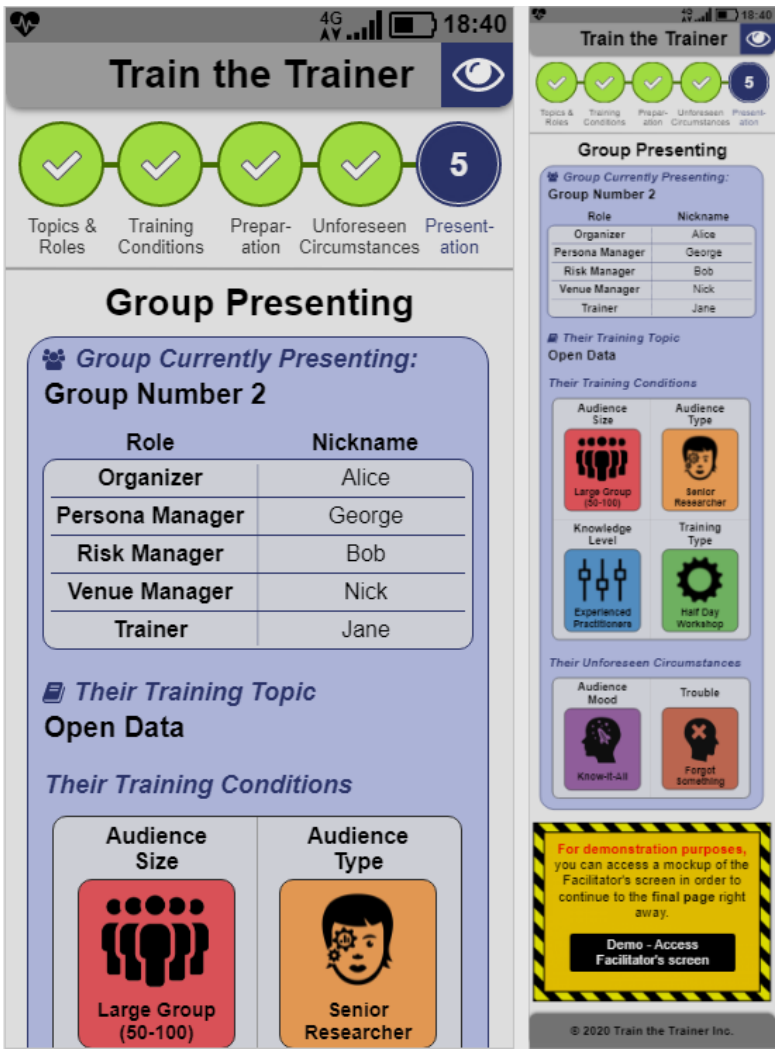

Figure 38: Prototype of the group presenting page, the part above the fold (left), and the entire page scaled down (right)

After the previewer presses the “Demo – Access Facilitator’s screen” button, they notice an improvised mockup of the facilitator’s screen, like the mockup illustrated in Figure 32. In order to move on to the workshop conclusion page, the previewer must press the single available button in the facilitator’s mockup screen, as seen in Figure 39.

Figure 39: An improvised mockup of the facilitator's screen used exclusively for demonstration purposes to allow previewers to autonomously transition from the "Presentation" stage to the "Workshop conclusion" stage

Stage 6: Workshop conclusion

At the end of the Train the Trainer workshop, the workshop conclusion page offers players two brief optional utilities: a few options to keep a copy of their workshop-related work and a way to provide feedback about their experience with the Train the Trainer workshop.

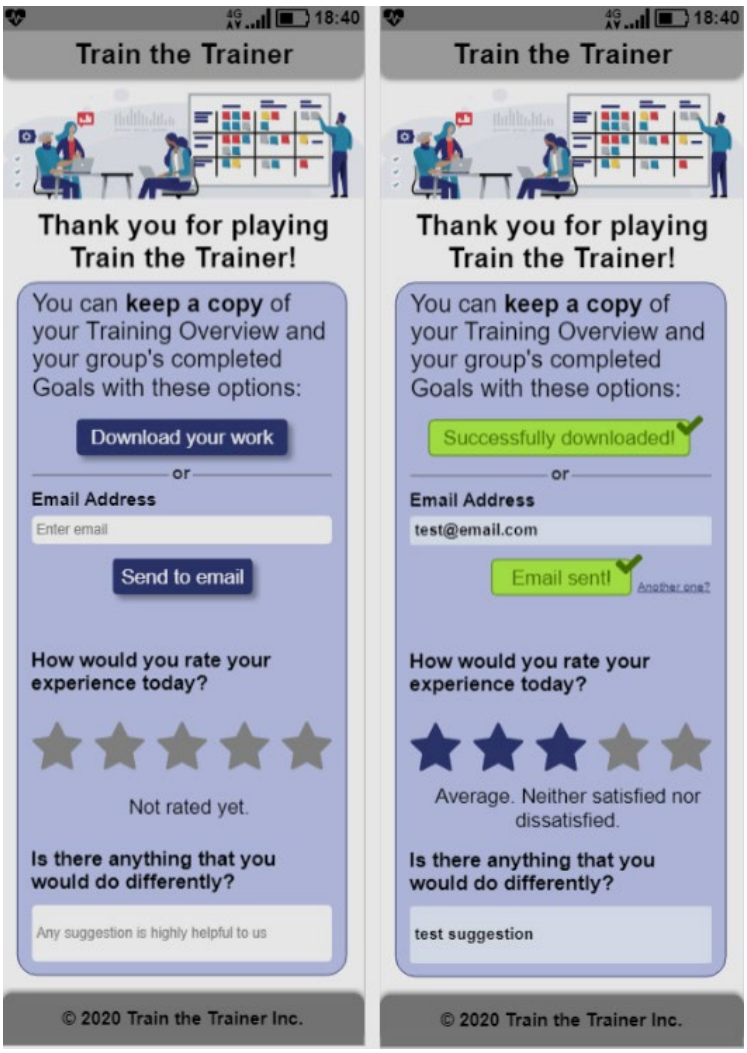

Figure 40: Prototype of the workshop conclusion page in its default state (left) and after interacting with it (right)

Concerning the first utility, a copy of a player's workshop-related work includes their Training Overview and their group's completed goals. They can either download a copy of their work locally on their device or send it to one or multiple email addresses of their choosing. The associated buttons are interactive, though we have not developed a work copy template and, consequently, have not implemented the functionality for downloading or sending copies of the player's work in our prototypes.

The second utility attempts to gather the player's feedback regarding their workshop experience by presenting two questions short in length to lessen the chances of survey fatigue cases. Initially, we ask the player to rate their level of satisfaction with the workshop activity on a scale of one to five, a question based on the Customer Satisfaction Score (CSAT) metric [32]. As illustrated in Figure 41, we employ a five-point descriptive scale ranging from the one-star "Very Bad. Very dissatisfied" option to the five-star "Excellent. Very satisfied" option. The player can select or switch a rating by pressing on the appropriate star. The follow-up question is open-ended and involves player suggestions that they believe would enhance their workshop experience. The player is not required to answer all or any of the feedback questions and can exit the application whenever they wish. Typically, the application would store the player's feedback for later use, a functionality our prototypes cannot attain.

Figure 41: The star-represented, five-point scale with matching labels, used by players to rate their workshop satisfaction level

4. EVALUATION

After encapsulating the essence of the digital Train the Trainer experience in interactive prototypes, we organized a moderated evaluation meeting with the creator of the physical card game to test the usability of our design and gather feedback on the overall experience.

The foremost benefit of usability testing is the ability to observe the user while they are browsing the application. If they are confused by some aspect of the application, we can recognize it through their body language and later build a discussion around it to understand what went wrong. Therefore, this evaluation method collects qualitative data, providing us with valuable information about the application's usability status.

Since it was unfeasible to hold a physical evaluation meeting, we carried out the meeting remotely, complicating our capability to monitor the user. Testing an application on the mobile environment further complicates matters, especially when requiring tracking their mobile gestures. To both address these issues and enabling us to monitor the user and their phone screen while also trying to minimize the preparation needed from the user, we suggested the following two alternative configurations to the creator:

- The user utilizes a web conference tool on both their mobile device and their computer. They join our web meeting on both devices, sharing their screen while browsing the prototypes on their mobile device and enabling their web camera on their computer.
- The user utilizes a web conference tool on their computer and a screen mirroring software on both their mobile and computer devices. They join our web meeting on the computer, sharing their screen and enabling their web camera. While browsing the prototypes on their mobile device, they mirror their phone screen onto their computer screen.

Below, we define all phases of the remote evaluation meeting in order and our methodology used:

1. **Before the meeting.** We decided to use the web conferencing tool Zoom since it supported our goals. Through email, we provided the creator with a short description of the procedure, meeting details, along with our previously mentioned configurations, of which they chose the first one.
2. **Introduction.** After welcoming and thanking the creator, we first asked for their consent to record the meeting for future reference. Then, after a brief discussion, we set up the first configuration as described so that both the creator and their mobile screen are visible.
3. **Prototype browsing.** When the creator was ready, we shared our prototypes and a short browsing scenario, which we asked them to read first. We then quietly observed the procedure for the duration of the prototype browsing, reminding and prompting them to share their thoughts by thinking aloud while interacting with the application [33]. It is important to note that we did not help the creator during browsing, and we did not answer or ask closed-ended questions, to avoid influencing the experience. In such cases, we responded with open-ended questions such as "what do you think about that?" to keep them unbiased.
4. **Discussion.** Lastly, we asked the creator open-ended questions about their experience with the application, following a semi-structured interview style.

Afterward, we analyzed our notes and the recording of the evaluation meeting in detail, leading us to the following findings:

- The prototypes did not clarify why someone could choose more than one role at the “Topics & Roles” stage.
- The training variable assignment spin wheel at stages 2 and 4 was pleasant and understandable. However, they noticed they were incapable of changing or switching cards when a combination of cards leads to an impossible or unwanted training situation for the group, commenting on the importance of that missing feature.
- During the persona creation at stage 3, the “Job Responsibilities” and “Challenges” fields were ambiguous and could be interpreted differently by different people. Additionally, they were surprised by the addition of negative persona traits and thought the “Occupation” field title does not cover academics.
- The application does not explain the purpose of the Training Points of goals.
- They commented positively on the overall interface of the prototypes, including the Training Overview, the presenting group’s page, and the stages step progress bar, and the navigation was easy. Nevertheless, they believed the purpose of the Training Conditions, Unforeseen Circumstances, and Assignment Options is not clear in all stages without remembering prior information, thus proposing that the relevant information should be retrievable whenever needed.
- Even though considered an enjoyable experience, they were skeptical about how it would play out in actual live settings, noting that if the facilitators and participants are not used to the application’s concept and rules, they might encounter difficulty fully understanding the process.

Ultimately, the evaluation meeting highlighted the interface’s legibility yet stressed the need for further explanation and guidance of the experience’s concept.

5. CONCLUSION AND FUTURE WORK

The aim of this project was to explore whether and how a mobile web application can guide and enhance a Train the Trainer workshop without deviating from its learning goals. Laying the groundwork for this project, the Train the Trainer physical card game of Ms. Gwen Franck helped us conceptualize a digital Train the Trainer experience. The digital environment impacted our design choices as it proved both an asset and a challenge to the application's practicability. With the intention of making the experience more engaging while remaining faithful to the Train the Trainer framework, this project proposed and introduced purpose-built trainer-related gamification elements. After specifying the user groups involved, the project proceeds to capture the experience's ideas in interactive prototypes for the target learning group – the workshop participants. During the prototyping process, the project acknowledged and applied several HCI design principles to ensure that the outcome is usable and appropriate for mobile use. The project concludes with our findings on the prototype's design practicality, which emerged from a usability evaluation meeting with the inventor of the card game.

Overall, this project casts a new light on the design of application-driven Train the Trainer workshops. Our approach highlighted the value of HCI guidelines for designing such an experience. Gamification greatly impacted the experience's design, with some gamification elements (stages, roles, goals) being more promising and befitting than others (score). Iterative prototyping assisted us in finding and fixing design mistakes early on, resulting in interactive, high-fidelity prototypes that approximate an actual mobile application, enabling testing with real users before implementing the application.

As mentioned in the project, some aspects of the experience that we argued are not of high priority at this initial design stage were overlooked or simplified. Moving closer to the application's implementation, future work should consider thoroughly addressing these aspects. These include but are not limited to: dealing with technical issues; designing the automatic grouping system based on participant preferences; managing actions that affect the entire participant's group; changing or/and switching unwanted training variable cards; and designing a template for the participant's downloadable copy of work.

This project outlined the general idea of the experience and then focused on the mobile end of the application and the workshop participant's perspective. Future work should investigate design solutions and prototypes for other platforms and user groups to make the experience more complete. Additionally, examining the possibility and applicability of a remote workshop experience could prove beneficial.

Although the evaluation meeting helped us identify some strong and weak points of the design, it is difficult to arrive at any conclusions since the sample size of our design's evaluation was small and not representative of actual users (the project's prototypes were not tested by potential workshop participants for a number of reasons which prevented the conduct of physical training workshops by the inventor of the card game). Therefore, this provides a noteworthy starting point for future studies, attempting to determine how practical the design is to its actual target audience and suggesting changes to the experience based on the results.

Looking forward, the results of this project are promising and provide a foundation for numerous future investigations and work that address current limitations, and further and more comprehensively approach the experience.

Since UX design is a multidisciplinary field, and considering the context of the Train the Trainer framework, future research could continue to explore and expand the theoretical background of the experience. Possible areas of interest that this project did not cover

include Accessibility and Design for All, as well as aspects of Computer-supported cooperative work (CSCW), and lifelong learning.

REFERENCES

[1] Hasa, "What is the Difference Between Workshop Seminar Symposium and Conference," Pediaa, 30 March 2021. [Online]. Available: https://pediaa.com/what-is-the-difference-between-workshop-seminar-symposium-and-conference/. [Accessed 23 June 2021].

[2] G. Franck, "Train the Trainer card game," 6 May 2019. [Online]. Available: https://gwenfranck.com/2019/05/06/train-the-trainer/. [Accessed 23 June 2021].

[3] P. Gleeson, "What Is the Train the Trainer Model?," Chron, 28 August 2017. [Online]. Available: https://work.chron.com/train-trainer-model-5463.html. [Accessed 12 May 2021].

[4] Centers for Disease Control and Prevention, "Understanding the Training of Trainers Model," 13 March 2019. [Online]. Available: https://www.cdc.gov/healthyschools/tths/train_trainers_model.htm. [Accessed 12 May 2021].

[5] Global Counterterrorism Forum and United Nations Counter-Terrorism Centre, "Training of Trainers (ToT) Curriculum," 11 July 2018. [Online]. Available: https://www.thegctf.org/Portals/1/Documents/Links/Web/Final%20ToT%20Curriculum%20on%20BSM%20(003).pdf?ver=2018-07-11-155356-060. [Accessed 12 May 2021].

[6] R. Cserti, "What is the train-the-trainer model and how can your organisation benefit from it?," SessionLab, 15 June 2018. [Online]. Available: https://www.sessionlab.com/blog/train-the-trainer-model/. [Accessed 12 May 2021].

[7] S. Quain, "The Difference Between Top-Down Teaching & Bottom-up Teaching," Classroom, 25 June 2018. [Online]. Available: https://classroom.synonym.com/difference-between-topdown-teaching-bottomup-teaching-12059397.html. [Accessed 12 May 2021].

[8] ACM SIGCHI, "Curricula for Human-Computer Interaction," Special Interest Group on Computer-Human Interaction Curriculum Development Group, New York, 1992.

[9] N. Avouris, C. Katsanos, N. Tselios and K. Moustakas, An introduction to human-computer interaction, Patra: Ekdoseis Panepistimiou Patron, 2016, pp. 14-16, 19-21, 222-224.

[10] International Organization for Standardization, "Ergonomics of human-system interaction - Part 11: Usability: Definitions and concepts," March 2018. [Online]. Available: https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en. [Accessed 18 May 2021].

[11] J. Nielsen, "Usability 101: Introduction to Usability," Nielsen Normal Group, 3 January 2012. [Online]. Available: https://www.nngroup.com/articles/usability-101-introduction-to-usability/. [Accessed 18 May 2021].

[12] "Illustration of usability hierarchy," Immunizations and health information technology, January 2015. [Online]. Available: http://www.immunizationsandhealthit.org/usability/. [Accessed 18 May 2021].

[13] J. Nielsen, "Enhancing the explanatory power of usability heuristics," in *SIGCHI Conference on Human Factors in Computing Systems*, Boston, 1994.

[14] Interaction Design Foundation, "What is User Centered Design?," [Online]. Available: https://www.interaction-design.org/literature/topics/user-centered-design. [Accessed 22 May 2021].

[15] T. H. Tran, "What does mobile-first design mean for digital designers?," InVision, 27 December 2019. [Online]. Available: https://www.invisionapp.com/inside-design/mobile-first-design/. [Accessed 25 May 2021].

[16] "Illustration of mobile-first design," Smartz, [Online]. Available: https://www.smartz.com/web-design/mobile-first-vs-mobile-responsive-design/. [Accessed 25 May 2021].

[17] N. Babich, "A Comprehensive Guide To Mobile App Design," Smashing Magazine, 12 February 2018. [Online]. Available: https://www.smashingmagazine.com/2018/02/comprehensive-guide-to-mobile-app-design/. [Accessed 25 May 2021].

[18] S. Deterding, R. Khaled, L. Nacke and D. Dixon, "Gamification: Toward a Definition," in *Conference on Human Factors in Computing Systems*, Vancouver, 2011.

[19] K. Turco, "Infographic: The History of Gamification," TechnologyAdvice, 18 October 2017. [Online]. Available: https://technologyadvice.com/blog/marketing/history-of-gamification-infographic/. [Accessed 13 May 2021].

[20] T. J. Brigham, "An Introduction to Gamification: Adding Game Elements for Engagement," *Medical Reference Services Quarterly,* vol. 34, no. 4, pp. 471-480, 2015.

[21] D. Teodorescu, "Gamification: A guide for designers to a misunderstood concept," UX Collective, 8 November 2018. [Online]. Available: https://uxdesign.cc/gamification-aguide-for-designers-to-a-misunderstood-concept-4de5bef0c5d9. [Accessed 13 May 2021].

[22] Interaction Design Foundation, "What is Gamification?," [Online]. Available: https://www.interaction-design.org/literature/topics/gamification. [Accessed 15 May 2021].

[23] "Open Science," European Commission, [Online]. Available: https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/open-science_en. [Accessed 23 June 2021].

[24] "How to play Jackbox Games," Jackbox Games, [Online]. Available: https://www.jackboxgames.com/how-to-play/. [Accessed 23 June 2021].

[25] S. Few, "Practical Rules for Using Color in Charts," *Visual Business Intelligence Newsletter,* pp. 6-7, February 2008.

[26] "Illustration of people collaborating," Excella, [Online]. Available: https://www.excella.com/training/private-training. [Accessed 24 April 2021].

[27] "Hex Color Codes, Paint Matching and Color Picker," Encycolorpedia, [Online]. Available: https://encycolorpedia.com/. [Accessed 25 April 2021].

[28] S. Subramaniyan, "The Rounded User Experience," UX Planet, 30 July 2020. [Online]. Available: https://uxplanet.org/the-rounded-user-experience-ff7a1898ab33. [Accessed 26 April 2021].

[29] C. Kilby, "A quick guide to writing better button labels," Medium, 11 March 2020. [Online]. Available: https://medium.com/sainsburys-digital-experience/a-quick-guide-to-writing-better-button-labels-69daecff3497. [Accessed 27 April 2021].

[30] N. Berman, "Multi-select dropdown - Axure Forums," Axure, 9 December 2018. [Online]. Available: https://forum.axure.com/t/multi-select-dropdown/52360/5. [Accessed 2 May 2021].

[31] HubSpot, "Make My Persona," HubSpot Inc., [Online]. Available: https://www.hubspot.com/make-my-persona. [Accessed 4 May 2021].

[32] S. Sahai, "Measuring Customer Experience Beyond NPS," Pointillist, [Online]. Available: https://www.pointillist.com/blog/how-to-measure-customer-experience-beyond-nps. [Accessed 11 May 2021].

[33] K. A. Ericsson and H. A. Simon, Protocol Analysis: Verbal Reports as Data (Revised Ed.), The MIT Press, 1993.