MYFORSCRUM: A New Digital Tool for Implementing Forscrum in Educational / Training Contexts

Carlos Luís[a] and Maria José Marcelino[b]
Department of Informatics Engineering (DEI) of the University of Coimbra, Portugal

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Abstract: This paper presents the development of an application (App) designed to support the management of training processes through the integration of the forScrum methodology. The App's primary objective is to facilitate collaborative work between learners and teachers/trainers, promoting efficient organization of training cycles (sprints) and fostering autonomy and self-regulation. The Design Thinking methodology was applied to create the prototype, enabling a Learner-Centered Design approach that allowed for a comprehensive understanding of stakeholders' needs, resulting in an innovative, effective, and efficient solution. This methodology comprised six-stage: empathy, definition, ideation, prototyping, testing and implementation, ensuring that the final product is functional and aligned with learner expectations. The paper also discusses the challenges encountered during the design and development process, as well as the implemented functionalities and the evaluation of usability, accessibility, and learnability within the learning ecosystem.

1 INTRODUCTION

In the 21st century, characterized by the rapid proliferation of applications and the accelerated pace of information technologies, as well as the development of Industry 4.0, it is imperative to adopt agile methodologies, "e.g., Scrum, eXtreme Programming (XP), Kanban, and Dynamic Systems Development Method (DSDM)", among others (Cubric, 2013) (Abbas et al., 2008) in education and training 4.0. These agile methodologies are based on iterative and incremental processes and have four characteristics in common: adaptive planning, iterative development, rapid and flexible response to change and the promotion and enhancement of communication (Begel & Nagappan, 2007) (Maher, 2009).

The possibilities of networked interaction have introduced new perspectives on knowledge production. The key challenge of digital education lies in preparing adults for a complex and increasingly unpredictable world, marked by diversity, interdependence, and dynamic relationships (Figueiredo, 2022), rather than merely promoting the adoption of new technologies (Amante et al., 2008). It is therefore imperative to design new paradigms for "lifelong learning," grounded in agile methodologies and strategies that enhance learners' engagement and active participation in the knowledge acquisition process (Moraes, 2001).

Numerous writers have investigated the use of agile approaches to training and education, leading to a variety of learning models, among other outcomes. For example, in their systematic reviews, A. López-Alcarria et al., 2019 (López-Alcarria et al., 2019) and P. Salza et al., 2019 (Salza et al., 2019) show that implementing agile methodologies in education improves performance, satisfaction, and motivation among faculty and students while also creating a learning environment that supports the development of responsible and sustainable citizens.

The eXtreme Teaching approach is the outcome of other authors' adaptations of Extreme Programming (XP) for the educational setting, including R. Andersson et al., 2006 (Andersson & Bendix, 2006) and R. Vuokko et al., 2007 (Vuokko & Berg, 2007). The Just-in-Time Feedback technique is used in project-based learning courses by V. Razmov et al., 2007 (Razmov & Anderson, 2006) and A. Delhij et al., 2015 (Delhij et al., 2015) explain how Scrum has been adapted for use in education using the eduScrum mode.

[a] https://orcid.org/0000-0001-5777-059X
[b] https://orcid.org/0000-0001-7153-2205

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In this paper, grounded in the design thinking methodology (Brown, 2008; Denning, 2013) and principles of Learner-Centered-Design (Soloway et al., 1994a), we analyze the methods employed in adult education and training processes and describe a prototype of an app that was developed for learning ecosystems, using the forScrum framework.

2 IMPLEMENTING AGILE STRATEGIES IN ACTIVE LEARNING

A significant volume of research has investigated the application of agile methodologies in educational and training contexts. Many studies have examined how frameworks originally designed for software development can be adapted to enhance learning environments, emphasizing collaboration, flexibility, and learner-centered approaches. In recent years, Scrum has gained widespread adoption, transcending its origins as a software development methodology to become a versatile framework for work and management in diverse sectors within large organizations (Sutherland, 2020). Willy Wijnands, a professor of chemistry/physics at Ashram College in the Netherlands, pioneered the application of Scrum in educational settings, integrating educational strategies, methodologies, and resources into a framework he termed eduScrum (Delhij et al., 2015; Devedžić & Milenković, 2011). The implementation of Scrum in educational practices has fostered a seamless integration of education/training and practical learning experiences (Devedžić & Milenković, 2011).

S. Duvall, et al. provide a method called Scrumage (SCRUM for AGile Education) in an effort to get around the need to make compromises. To meet their unique learning requirements and preferences, they give each student in a course the option to choose from a variety of educational approaches and sets of materials (Duvall et al., 2018, 2020).

Xiang J. and Han C. propose an interdisciplinary teaching framework, TL-Scrum (Teaching and Learning-Scrum), that leverages the agile development methodology to improve students' teamwork skills within physics education. This approach, grounded in Scrum principles, comprises six key phases: setting task objectives, forming study groups, defining learning goals, overseeing study schedules, communicating learning outcomes, and reviewing the overall learning process. This structured, agile-based model fosters collaborative learning and aligns instructional practices with team-oriented skill development.(Xiang & Han, 2021).

The concept of Agile Learning Loops (ALL), from K Böhm, Y Unnold and PV Zahorodko, involves the methodological adaptation of the SCRUM framework alongside loop-oriented learning models - such as Single-, Double-, and Triple-Loop Learning to create an organizational framework tailored for higher education. This approach serves as a design structure for learning within Problem-Based Learning (PBL) environments (Böhm & Unnold, 2021)(Zahorodko, 2023).

The forScrum framework was specifically developed for professional training, with the aim of adapting the principles and practices of the Scrum methodology to the needs of learning environments focused on building professional competencies. This model employs a holistic approach that incorporates various pedagogical strategies, including analogies to heutagogy, to foster a flexible, self-directed, and collaborative learning experience. Trainees are encouraged to take an active role in their learning process, embracing responsibility and engaging in team-based problem-solving within real-world professional contexts. This agile structure supports not only skill acquisition but also the development of self-determined learning capacities essential for lifelong learning (Luís et al., 2022, 2023).

3 RESEARCH METHODOLOGY AND TOOLS

To achieve the objective of this study, the Design Thinking and Learning Centered Design methodologies were applied to ensure a comprehensive, learner-centered approach in the prototype's development. Design Thinking, a methodology emphasizing user-centricity, aims to deeply understand the needs of learners through a six-stage iterative process: empathizing, defining, ideating, prototyping, testing, and implementing (Brown, 2008; Gibbons, 2016). This approach promotes innovative solutions by actively engaging users and stakeholders in the creative process, thus ensuring that the final outcome aligns closely with real learning expectations and requirements. In this study, Design Thinking was instrumental in facilitating the generation and testing of ideas, fostering an environment of open collaboration and learning.

In parallel, Learning Centered Design focuses on developing solutions that address not only functional requirements but also the specific learning and developmental needs of the learner (Quintana et al., 2013; Soloway et al., 1994b). This methodology shaped the prototype's development by centering the design process around effective educational experiences, where learning objectives, intuitive interaction, and learner development support were paramount. This method is particularly well-suited for educational tool development, as it guides the design process to enhance both usability and pedagogical efficacy.

To further support the prototype's development, Unified Modeling Language (UML) diagrams, including use case and class diagrams, were created to represent user interactions and system structure systematically (Rumbaugh et al., 1999). These diagrams provided a visual framework that clarified the relationships and interactions within the prototype, serving as a blueprint for the functional design. The actual prototype was developed using Figma, a collaborative design platform, which allowed for precise interaction design and easy adjustments based on iterative feedback.

The combination of these methodologies, alongside structured UML modeling and the use of Figma, enabled the creation of a robust prototype that effectively addresses both learner needs and educational objectives.

4 DESIGN APPROACH

In this iterative and flexible model, the focus remains firmly centered on learners' needs, enabling the design to be continuously refined based on feedback and new insights throughout the process. The three core phases of Design Thinking — Understand, Explore, and Materialize (Gibbons, 2016) — have been thoroughly examined, providing a methodological framework aimed at ensuring that the solutions developed are genuinely user-centered. The Understand phase emphasizes an immersive, in-depth analysis of learners' needs; the Explore phase fosters the generation and refinement of innovative ideas; and finally, the Materialize phase centers on prototyping and the practical implementation of solutions, ensuring that the design effectively and engagingly meets educational objectives.

4.1 Understand - Empathize and Define

To gain a deeper understanding of the learners, data collection was grounded in ethnographic research, adopting an 'emic perspective' (Eriksson & Kovalainen, 2015; Paul et al., 2003), to gather observational notes directly from their experiences.

The absence of dedicated applications compatible with the framework posed significant challenges for the learners, limiting their ability to fully explore the methodological and technological tools available. This gap compelled students to resort to alternative solutions, which often proved inadequate for meeting the specific needs of their projects. As a result, learners experienced a fragmented learning journey, where support tools were not aligned with the educational and technical goals of the framework. These limitations hindered the comprehension and practical application of key concepts, as learners had to invest additional time in adapting and improvising resources to enable a partial implementation of the process. The lack of dedicated applications thereby compromised the fluidity of the learning process and students' confidence in using the framework, highlighting a pressing need for tools specifically developed to support this educational approach.

4.2 Explore – Ideate and Prototype

During the training sessions, and as new challenges emerged, the primary difficulties encountered by the learners throughout the formative process were identified and discussed. Each issue was collaboratively analyzed, creating a space for dialogue among all participants to achieve a deeper understanding of the limitations associated with the use of the available tools. Once specific problems were identified, various viable solutions were proposed, aiming to minimize interruptions and enhance the learning experience.

Among the solutions discussed, the proposal to develop a single application that could centralize all necessary functionalities quickly became a consensus among participants. This application would aim to eliminate the need to switch between different platforms, a practice that learners repeatedly identified as a source of frustration and time inefficiency.

During the development process, UML diagrams were created to structure and visually represent the components and functional flows of the proposed application. These diagrams provided a clear and systematic overview of the application's architecture and anticipated interactions, serving as a robust foundation for subsequent design stages (Silva, A;Videira, 2005). Building upon this initial modeling, low- and high-fidelity prototypes were developed to iteratively test and refine the application's interface and functionality (Lauff et al., 2018).

4.3 Materialize – Test

Usability testing is a critical step in prototype development, allowing for the assessment of user interaction with the proposed system in terms of effectiveness, efficiency, and satisfaction. Among the methodologies employed, Thinking Aloud out (Nielsen, 2012), and heuristic evaluation (Nielsen, 1993, pp. 155–163) stand out. In the Thinking Aloud method, users verbalize their thoughts, actions, and difficulties as they navigate the system, providing direct insights into the user experience and facilitating the identification of usability barriers that might otherwise go unnoticed in conventional analyses. On the other hand, heuristic evaluation is conducted by experts who examine the system against established design principles to identify usability issues in a structured manner.

Interestingly, even with more complex interfaces, the combination of these two methodologies proves highly effective: through the Thinking Aloud method, groups of five evaluators were able to identify more than half of the usability issues (Molich & Ballerup, 1990), while the heuristic evaluation complemented the analysis by highlighting additional issues based on recognized heuristics. These results underscore the robustness of these methodologies in detecting critical flaws and fostering a design that is more intuitive and aligned with actual user needs. By enabling adjustments grounded in empirical feedback and heuristic principles, usability testing becomes an indispensable resource for optimizing the user experience, ensuring that the system is functional, intuitive, and accessible.

5 THE PROTOTYPE

Before addressing the prototyping phase, it is essential to present the use case diagrams that define the application's functional requirements.

The use case diagrams for Trainer (Figure 1) and Learner (Figure 2) illustrate the main functionalities and interactions that each type of user can access within the application. These diagrams provide a clear view of the functional requirements by detailing user behaviors and the connections between various use cases. Together, they meet the specific needs of each user group, demonstrating how the app supports agile project management and collaborative learning. Additionally, by offering a foundational framework for the development and execution of the app's features, these diagrams ensure that the design adheres to accessibility and usability guidelines for all users.

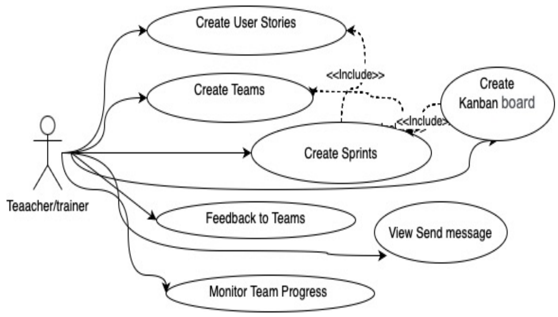

Figure 1: Use Case Diagram Teacher /Trainer.

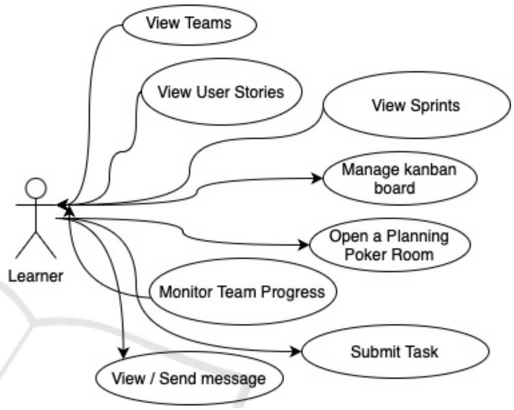

Figure 2: Use Case Diagram Learner.

Building on these diagrams, the subsequent step involved the development of low-fidelity prototypes. These prototypes provided a foundation for a series of usability tests, enabling iterative refinement of the interface and functionalities based on user feedback. Low-fidelity prototypes are particularly advantageous at these initial stages, as they allow for rapid adjustments in response to usability findings, focusing on core design elements without the constraints of complex visual details. This approach ensures that essential user interactions and navigational flows are thoroughly evaluated, establishing a robust foundation for further development.

In developing this App, consistency was prioritized to ensure a smooth and predictable Learner experience (LX) (Ahn, 2019). The use of uniform interface elements, such as icons, buttons, and navigation structures, was carefully adjusted to foster intuitive interaction and reduce cognitive load (Budiu & Nielsen, 2011). Fitts's Law was considered in the placement and sizing of interactive elements, optimizing accessibility and navigation efficiency (Grosjean et al., 2007). Furthermore, the selection of the Nested Doll and Dashboard patterns reflects the application of Hick's Law, facilitating information organization and simplifying decision-making processes for users throughout their navigation (Proctor & Schneider, 2018).

The usability tests conducted with learners were carried out using a functional prototype developed in Figma, though it had no connection to databases. Therefore, the Wizard of Oz technique (Dahlbäck et al., 1993b, 1993a)was used in conjunction with the 'think aloud' method. This approach enabled direct observation of user interactions with the prototype, capturing their real-time reactions and interpretations.

To evaluate the usability and organization of the layout, a series of tasks was designed to test the interface's functionality and clarity. Seven tests were conducted with educators and seven with learners, following the theoretical framework proposed by Jakob Nielsen and Tom Landauer (Nielsen, 2000).

The tasks included creating user stories, configuring a sprint, and setting up a Scrum Poker room. However, the prototype's HUB layout, intended to centralize navigation by providing access to multiple areas from a single location, did not align with the learners' mental models. This misalignment led to navigational difficulties and disrupted the interaction flow, emphasizing the importance of an intuitive design that meets user expectations and minimizes cognitive load.

The layout in Figure 3 represents the initial menu; Figure 4 presents a Kanban board with user stories, and Figure 5 displays the curricular units.

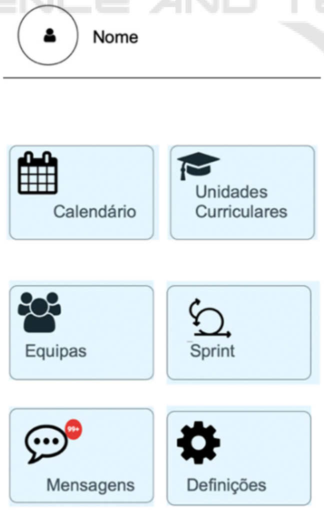

Figure 3: Initial menu (Calendar, Curricular units, Teams, Sprint, Messages and Settings).

Based on user experience, the decision was made to implement the Nested Doll and Tabbed View design patterns, as these proved to be more aligned with the learners' expectations and familiarity.

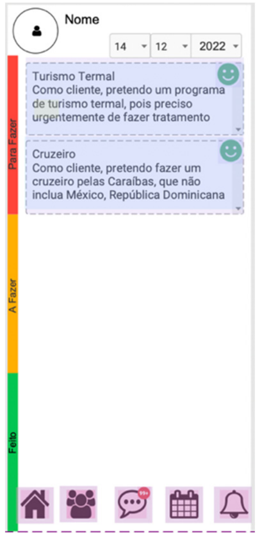

Figure 4: Kanban board with user stories, (Thermal tourism and Cruzer).

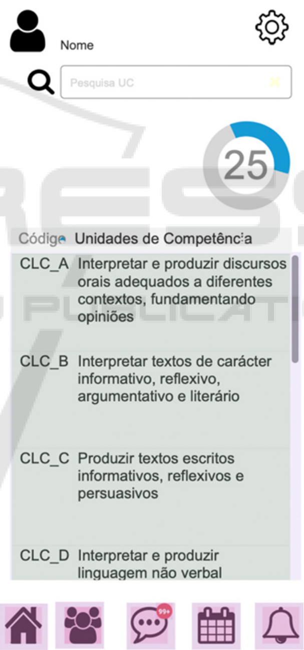

Figure 5: Curricular Units.

The selection of these patterns is due to their capacity to provide a clear hierarchical structure and organized access to various sections, adhering to the principles of internal and external consistency one of Jakob Nielsen's heuristics (Nielsen, 2020). This approach allows learners to navigate the interface more easily, benefiting from an intuitive organization that promotes immediate recognition of functionalities and reduces cognitive load, in line with Jakob's Law (Nielsen, 2020). (Figure 6, 7 and 8).

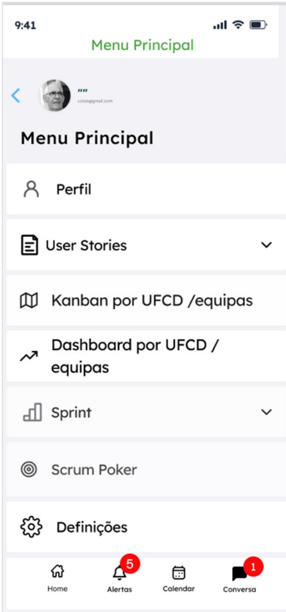

Figure 6: Main Menu.

Figure 7: Kanban board with user stories.

6 CONCLUSIONS

The prototype presented here is designed to support the agile forScrum methodology, emerging as an essential tool for transforming educational and training practices and advancing Education/Training 4.0. By structuring and monitoring sprints and associated tasks, this app promotes a learner-centered pedagogical model that facilitates the adaptability and flexibility required to address the challenges of an ever-evolving digital context.

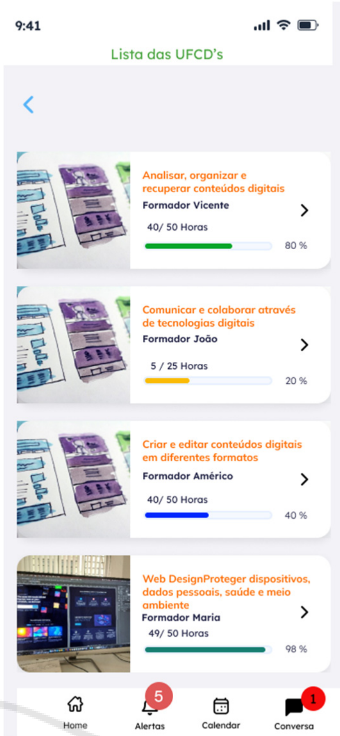

Figure 8: Curricular Units.

The simplicity of the application, combined with principles of usability and accessibility, ensures that learners with low digital literacy can actively participate in the preparation, execution, and learnability is a core element, essential to guaranteeing a smooth transition to agile practices without significant barriers. This approach thus promotes an inclusive and intuitive learning experience.

In the context of Education 4.0, which goes beyond traditional pedagogical and andragogical approaches, new practices such as heutagogy, peeragogy, and cybergogy have emerged, which are fundamental to a learner-centered education (Cherusheva et al., 2023; Miranda et al., 2021). This perspective encourages self-directed learning, emphasizing humanistic and constructivist principles that motivate learners to take responsibility for their own development.

Future work will focus on developing a fully functional application that embodies these concepts, further contributing to an inclusive, learner-driven, and agile educational ecosystem aligned with the principles of Education 4.0.

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