An exploratory study on the USARP method: improving the usability requirements elicitation and specification

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Abstract. *USARP (USAbility Requirements with Personas and User stories) is a method for eliciting and specifying usability requirements using personas, user stories, and usability guidelines organized as cards. USARP suggests brainstorming sessions to discuss usability requirements oriented by its cards. We conducted an exploratory study in an academic environment to analyze the use of USARP in projects developed by undergraduate students acting as software engineers. We noted difficulties in selecting cards to use during the USARP adoption. Thus, this study proposes to evolve USARP to provide a more effective way to elicit and specify usability requirements. We reviewed the cards, removing redundant content and combining cards with similar content. Also, we proposed a checklist and a board to guide the selection of the cards according to users and system characteristics. Finally, the process suggested for adopting USARP was updated to reflect the use of the new artifacts. In this extended version, we provide an example of USARP in practice. We expect these improvements could guide the customization of the brainstorming sessions to be more effective and efficient.*

1. Introduction

Usability can be understood as a system or product's ability to achieve goals with effectiveness, efficiency, and satisfaction in a given use context [for Standardization 2018]. Usability is relevant because it is essential for software to keep users focused on their objectives and promote a good experience [Nielsen 1994]. Usability and the user experience impact the acceptance of software by end users [Teixeira et al. 2021].

When usability is considered in the web interface development process, it is possible to reduce the time to access information, make information readily available to users, and avoid the frustration of not finding desired information on the site [Winckler and Pimenta 2002]. The user interface is built through presentations of information, data entry and request, controls, and commands [Nielsen 1994]. The interface defines the way of capturing information available to the user and can influence the absorption of content and aid or hinder the cognitive process [Lévy 1993].

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To represent usability characteristics in software design artifacts, some techniques have been proposed in recent years, such as the USINN notation (USability-oriented INteraction and Navigation model) [Marques et al. 2017], the UDRT-AD technique (Usability Design Reading TechniquePrototypingty Diagrams) [Silva et al. 2016], and guidelines for prototyping considering usability aspects [de Oliveira Sousa and Valentim 2019]. For techniques and notations like these to be better utilized in a project, it is necessary to identify and specify the usability requirements to be met by the system [Marques et al. 2018].

In light of this need, Oliveira Junior et al. [de Oliveira et al. 2020] developed USARP (USAbility Requirements with Personas and user stories), a method for eliciting and specifying usability requirements using personas, user stories, and usability guidelines. USARP suggests the creation of personas to serve as a basis for identifying user stories aligned with the needs of the personas. Usability guidelines can be adopted to enrich the user stories with usability mechanisms to be addressed.

This research investigates using USARP [de Oliveira et al. 2020] to evolve its procedures and artifacts for eliciting and specifying usability requirements. To achieve this objective, the following steps were taken: (1) conducting an exploratory study to identify difficulties in using USARP, (2) reviewing the cards and creating new artifacts for USARP, and (3) evolving the USARP procedures.

2. USAbility Requirements with Personas and user stories (USARP)

USARP aims to assist in eliciting and specifying usability requirements using personas, user stories, and usability guidelines. The persona technique suggested by USARP is the PATHY (Personas empATHY) technique, created by Ferreira et al. [Ferreira et al. 2016], which aims to create personas based on empathy maps to assist in identifying user requirements. The usability guidelines adopted in USARP were proposed by Juristo et al. [Juristo et al. 2006], called USability Elicitation Patterns (USEPs), for eliciting functional usability requirements. The process suggested for adopting USARP is illustrated in Figure 1 and consists of the following:

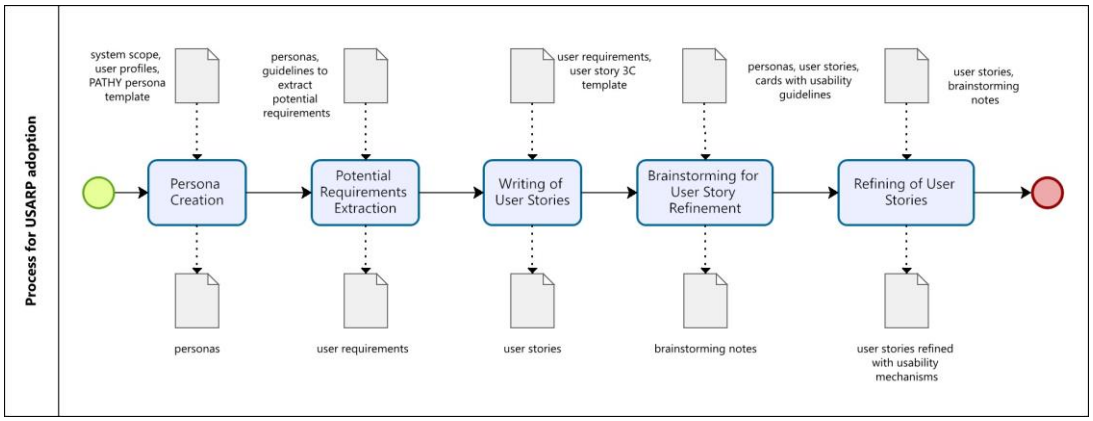

Figura 1. The process for adopting USARP.

1 - Persona Creation: Personas are created to represent relevant user profiles for the software and their needs.

2 - Potential Requirements Extraction: An analysis of the created personas is performed to identify user requirements that will be transformed into functional require-

ments.

3 - Writing of User Stories: The requirements extracted in the previous step are written in the format of user stories. The user stories follow the structure Jeffries (2001) proposed, named as 3C - a card with the text, a conversation to better detail the story, and verification through acceptance criteria.

4 - Brainstorming for usability requirements elicitation: During brainstorming sessions, the team discusses usability mechanisms that should be implemented with the user stories. The USARP cards are consulted to decide whether each usability mechanism needs to be selected. The team takes notes about the usability aspects identified as relevant to each user story.

5 - Refining of User Stories: Following the 3C template, the user story conversation is refined with the decisions made in the previous step. The user stories are enriched with the usability mechanisms associated. Thus, each user story will have a set of related usability mechanisms. The acceptance criteria can be refined to reflect the new information about the user story.

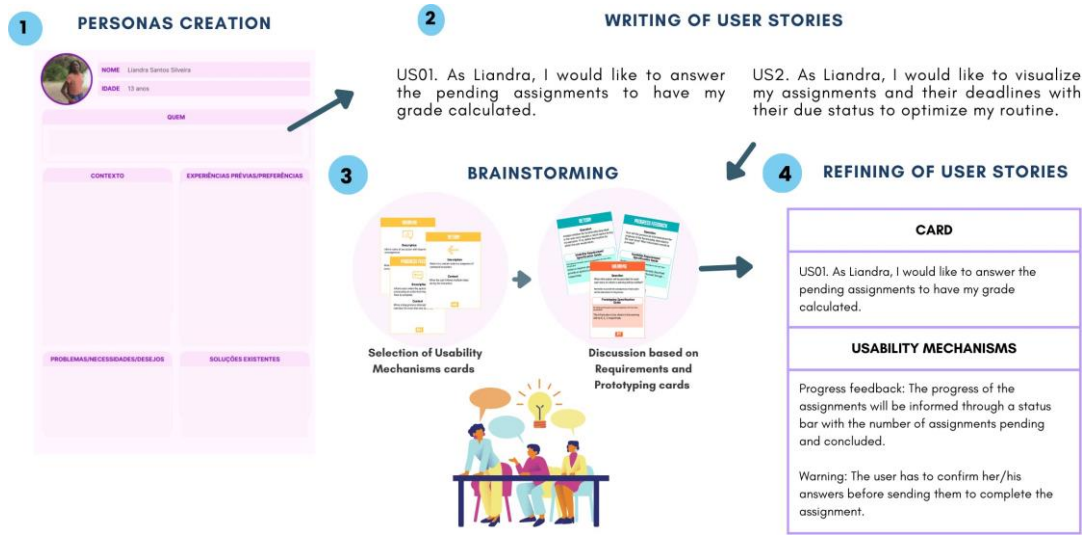

Figura 2. Example of USARP process steps.

USARP suggests a set of cards classified as (A) Usability Mechanisms, (B) Usability Requirements, and (C) Prototyping. The cards of the **Usability Mechanisms** type contain the elements: icon, description, and context of the usability mechanisms. The cards of the **Usability Requirements** type contain questions to assist in obtaining usability requirements and a guidePrototypingying usability requirements in the user story. The **Prototyping** cards have the same structure as the **Usability Requirements** cards (questions and specification guide) but aim to support the obtaining and specification of information for creating prototypes that depict usability mechanisms. Figure 2 presents an illustrative example of using the USARP cards to specify usability aspects of a user story. In Figure 3, we can see examples of the USARP cards related to the progress feedback mechanism.

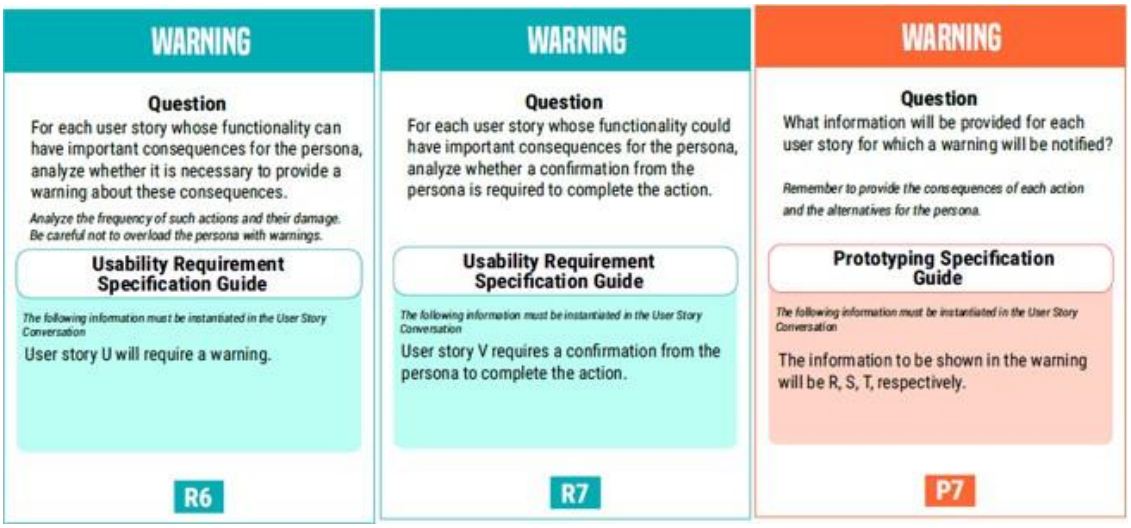

Figura 3. Example of USARP cards.

3. Related Works

This section will describe related works that present requirements engineering methodologies focusing on usability and interface prototyping.

Martinelli et al. [Martinelli et al. 2022] presented ACUX (Acceptance Criteria of User Stories), a set of guidelines that supports software teams in writing user experience requirements while elaborating acceptance criteria. The procedures are organized into two design aspects: interaction design and visual elements. A case study in the industry indicated high acceptance of ACUX by professionals and evidence of its effectiveness for writing acceptance criteria.

Gonçalves and Rocha [Gonçalves and da Rocha 2019] proposed a methodology that uses HCI (methods, techniques, standards, and patterns) to assist in developing interactive systems and user interfaces. Based on the ISO/IEC/IEEE 12207:2017 standards, the developed approach corresponds to the following stages: 1) IUI (Intelligent User Interfaces) analysis and requirements, (2) IUI design and implementation, and (3) IUI verification and validation. The study's authors intend to peer-review and apply the methodology in real works to validate and improve the process.

Teixeira et al. [Teixeira et al. 2014] conducted a study presenting a new perspective on requirements engineering for a system created for the healthcare area. A mediator and Prototyping assisted in the requirements elicitation, management, and prototyping. The methodological process was divided into the following steps: (1) Startup Meeting, (2) 1st Prototype Version, (3) 1st Validation and Redesign of the Prototype, (4) 2nd Prototype Version, (5) 2nd Validation and Redesign of the Prototype. As a result of the study, the authors found that the platform used for requirements elicitation had a high adoption rate and user satisfaction, suitable for use in healthcare projects.

This work is based on the application of USARP [de Oliveira et al. 2020], aiming to promote its ePrototypingr adequate support in eliciting usability requirements and prototyping.

4. Exploratory Study

In this section, we present the planning, execution, and results of the exploratory study based on the case study methodology. According to Travassos [Travassos et al. 2002], case studies are used to monitor projects, activities, and assignments. In Software Engineering, case studies are used primarily for experimental purposes.

4.1. Planning

To conduct the exploratory study, a graduation class taking the Software Engineering course at the Federal University of Ceará, Russas campus was selected. This course is a mandatory discipline for Computer Science students and an optional discipline for Software Engineering students. The objective of the discipline is to introduce, through the study of Software Engineering concepts, the basic knowledge necessary to understand the functioning of software processes, requirements elicitation, and project management.

USARP was used in a practical discipline work involving the Requirements Engineering process. Participation in the study was optional and would not affect the student's grades if they did not participate. One of the authors of this article was a teacher of the discipline. The class consisted of 51 students. For the practical work, the class was organized into teams of 3 to 6 students. The exploratory study was conducted during the emergency remote teaching period in the semester 2021-2. The objective of the exploratory study according to the Goal-Question-Metric (GQM) paradigm [Van Solingen et al. 2002] consisted of **analyzing** the USARP method **with the purpose of** evaluating **in relation to** difficulties in use and opportunities for improvement **from the point of view of** researchers **in the context of** a practical work on Requirements Engineering conducted by Software Engineering students organized in remote teams.

Because it was conducted in a remote environment, monitoring the participants' adoption of USARP during the practical work was impossible. Data were collected on the participants' perceptions regarding the usefulness and ease of use of USARP, possible difficulties in its adoption, and suggestions for improvements. Data were collected through an online questionnaire based on the TAM model [Venkatesh and Bala 2008] and open questions about difficulties and suggestions for improvement. The questionnaire contained the consent form, which explained voluntary participation and guaranteed confidentiality of the data during the analysis and dissemination of research results.

4.2. Conduct of the exploratory study

To use USARP, knowledge about requirements elicitation, specification of requirements with user stories, creation of personas, and usability requirements is required. The discipline addressed these concepts through video and practical classes conducted by the teacher. USARP was demonstrated in one of the classes to provide students with the necessary basis to use it later in the practical work.

The practical work consisted of analyzing existing requirements documentation and making improvements to the documentation: (i) creation of personas to represent the different user profiles of the system; (ii) rewriting system requirements in the format of user stories; (iii) creation of a traceability matrix between personas and user stories; (iv) enrichment of user stories with the specification of usability mechanisms to be met. The

students should use USARP to support the tasks proposed. The requirements documentation was related to an academic system and followed the IEEE 830 standard for requirements specification [Committee and Board 1998]. As supporting material on USARP, a website[1] about the technique and a virtual board with the cards organized for use during the task were provided.

The students organized themselves into nine teams. The practical work was carried out for three weeks. After delivering the practical work, the teacher encouraged the students to respond to the questionnaire, aiming to contribute to the evolution of USARP, and made it clear that the content of the responses would not influence the grades obtained in the practical work. Thirty-two responses were received.

4.3. Analysis and discussion of the obtained results

The analysis of the results of the exploratory study was carried out through documentary analysis of the delivered works and analysis of the responses received in the questionnaire. Qualitative and quantitative analysis methods were adopted to investigate the participants' experience with USARP.

The documentary analysis was carried out by two researchers aiming to identify the correctness and completeness of the documentation. It was analyzed which user stories were enriched with usability aspects through the USARP cards. This analysis provided evidence that some teams had difficulties associating the USARP cards with the user stories since (i) some teams chose only one usability mechanism for each user story, (ii) some teams did not specify the usability requirement, only indicating the name of the usability mechanism related to the user story; (iii) in general, some usability mechanisms were underutilized, such as the preference and personal object areas mechanisms; (iv) two teams did not use USARP. From the Lackarchers' point of view, such difficulties could be related to the lack of guidelines/recommendations on selecting the necessary USARP cards for enriching the user stories.

4.3.1. Quantitative analysis

The data obtained through the questionnaire were tabulated and analyzed quantitatively. Two respondents indicated that they did not use USARP in the practical work and only answered the open questions about difficulties in using USARP.

Figure 4 presents the results regarding the perception of USARP for eliciting usability requirements. Most participants partially or fully agree (13 and 16, respectively) that USARP is useful for eliciting usability requirements. Twelve participants partially agree, thirteen fully agree that using USARP would improve performance in eliciting usability requirements ("I believe in having identified more usability requirements in a shorter time than it would take without using this method"), four participants remain neutral, and one partially disagrees.

Regarding the usefulness of the cards, the prototype specification card was noted that some participants found to be hindering. Thus, a more detailed analysis of the use of this category of cards is necessary. For 25 participants (who partially or fully agreed),

[1]https://usarp.github.io/

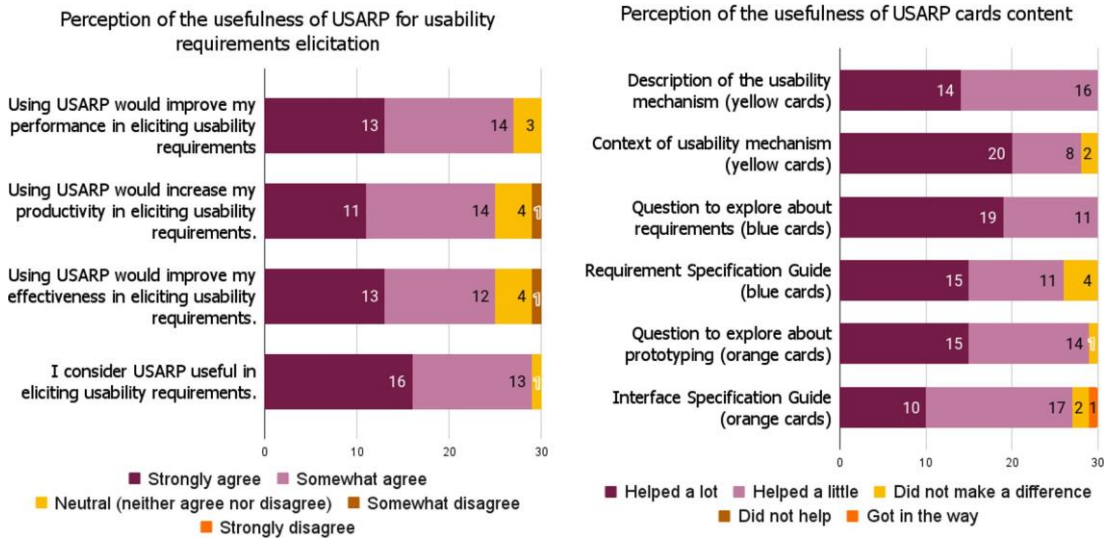

Figura 4. Participants' perception about USARP.

using USARP would increase productivity in eliciting usability requirements. However, four participants remained neutral, and one somewhat disagreed. In addition, 25 participants (who partially or fully agreed) believed that using USARP would improve effectiveness in eliciting usability requirements (believed to have identified a more complete set of requirements than they would have identified without using the method). Only four remained neutral regarding the statement, and one partially disagreed. Therefore, USARP is helpful for eliciting usability requirements and allowing for increased efficiency, speed, and improved elicitation of usability requirements.

4.3.2. Qualitative analysis

Open and axial coding procedures based on Grounded Theory (GT) were used for data analysis, based on coding from identifying excerpts used as codes and categories. The ATLAS.ti software[2] was used for data analysis and manipulation. The qualitative analysis of this research was conducted by one researcher and then validated by a second researcher. The open-ended questions analyzed qualitatively were: **Q1.** What characteristics of USARP do you consider to assist in eliciting usability requirements? **Q2.** What characteristics do not help or do not help in the way you would like?

Through the open and axial coding procedures, the following categories were identified: (I) challenges/difficulties in eliciting usability requirements, (II) characteristics of USARP that assist in eliciting usability requirements, and (III) challenges and difficulties that prevented the team from using USARP in practical work.

Challenges/difficulties in eliciting usability requirements: This category explores the codes related to aspects that made it difficult but did not prevent the use of USARP by participants. Some quotes Quantitymentioned below to evidence the obtained results.

Quantity of cards makes the procQuantityng: presents the participant's report who

[2]https://atlasti.com/

considers that the quantity of cards makes the process tiring, as in the report of P7: *"The cards help a lot during requirements elicitation. However, many cards make the process tiring and complicated maDifficultyse not all cards are necessary for a project."*

Difficulty in understanding UDifficulty: presents the participants' reports who cQuantityhave had difficulty in understanding the USARP cards, and the quantity of cards makes the process tiring, as in the reports of P12 and P8:

"The only negative characteristic was the difficulty in understanding how to use it, but with a little effort, it was possible to understand." - P8

"On the other hand, it is time-consuming and confusing in the first uses." - P12

Does not help in individual work: presents the participant's report who considers that USARP does not help in individual work, as in the report of P2: *"The fact that it is possible to work in a group using the persona method. I don't think itLacka suitable method for those who like to work alone."*

Lack of organization made understandiLackifficult: presents the participant's report that states that the lack of organization made understanding difficult and prevented the use of USARP, as in the report of P31: *"Lack of organization/time to absorb the method."*

USARP cards could be more detailed: presents the participant's report suggesting an improvement, that the USARP cards could be more detailed, as in the report of P32: *"Could be more explanatory and detailed, but helped."*

Characteristics of USARP that aid in usability requirement elicitation: This category compiles codes that indicate positive characteristics of USARP. Since this research focuses on improvement opportunities, this category will be briefly described to provide an overview of the results. Some of the identified codes were: (I) The disposition of information in the card facilitates elicitation of requirements, (II) The specification guide assisted the process, (III) Transformation of requirements into User Stories facilitated the elicitation of new requirements, (IV) The cards expand the project vision, (V) USARP cards assist in the classification of requirements, (VI) USARP cards assist in identifying requirements quickly, (VII) USARP cards assist in improving user stories.

Information in cards facilitates elicitation of requirements: presents the reports of participants who state that the disposition of information in the card facilitates elicitation of requirements, as in the reports of P5 and P6: *"The disposition of information on the card makes it easy and fast to find the necessary data for eliciting requirements"* and *"the description with the context in which a certain requirement will be used aided in weighing the requirement too."*

Specification guide assisted the process: presents the reports of participants who consider that the specification guide assisted the process, as in the reports of P13 and P15:

"The specification guide helped a lot" - P13.

"The usability requirement specification guide has always been a good guide when we develop the work" - P15.

User stories facilitated elicitation of usability requirements: presents the reports

of participants who consider that transforming potential requirements into user stories facilitated the elicitation of new requirements, as in the description of P9: *"Transforming requirements into user stories greatly facilitated eliciting new requirements, as it becomes easy to identify in user stories the requirements that best meet each brainstorm card [...]"*.

The cards expand the project vision: presents the reports of participants who state that the use of the cards broadens the understanding and comprehension of the project, as in the words of P26 and P27:

"The USARP method facilitates thinking beyond what we are used to, such as perceiving specific points." - P26.

"They help to have a broader view of the whole application, helping to better understand the entire scope and functionality." - P27.

Challenges and difficulties that prevented the team from using USARP in practical work: This category encompasses two identified codes that aid in understanding what pDifficultyhe teams from adopting USARP in practical work.

Difficulty in understaDifficultymethod: presents the participant's report that states that difficulty in understanding the method prevented the team from using USARP in practical work, as in the description of P17: "Lackied to use it, but I had difficulty with the method."

Lack of Lacknization: presents the participant's report that states that the lack of organization prevented the team from using the USARP method in practical work, as in the description of P19: "Lack of organization/time to absorb the method."

After analysis, it was possible to identify that, for participants, USARP has positive aspects, such as the use of personas and user stories and the transformation of potential requirements. However, necessary improvements were observed that could positively impact participants' experience. One of the negative aspects of the method mentioned by participants is the large number of cards and procedures for using them. In this sense, an approach was proposed to support the selection of cards for use in a specific context.

4.4. Threats to validity

In all experimental studies, some threats can affect the validity of the results. The main threats to the validity of this study are discussed below.

Firstly, the sample consists only of students from a single institution. The homogeneity of the sample may limit the ability to generalize the results. On the other hand, as the objective of the exploratory study was to identify opportunities for improvement, the sample was representative as it consisted of novice software engineers who may face challenges in learning and adopting USARP.

Another threat is the representativeness of the artifacts used. The requirements document used in the practical work consisted of documentation developed in an actual project. Regarding the researcher bias during the execution of the study, students were informed that USARP is under evaluation and evolution so that students would not be afraid to provide constructive criticism about the technique. Although using the technique was an activity in the discipline's practical work, the evaluation of the method did not generate a grade for the class, and filling out the evaluation questionnaire was optional.

To validate the effectiveness and efficiency of the proposed new process, new experiments should be conducted.

5. Refinement of USARP

Based on the knowledge acquired from analyzing the method's data, it was necessary to create an artifact to assist with the selection of cards.

Cards review: A card review was performed to remove redundancies to optimize the time taken to adopt USARP. Eight cards were removed, and their content was combined with existing and related cards. Figure 5 illustrates the refinement of usability requirement cards related to the Progress Feedback mechanism.

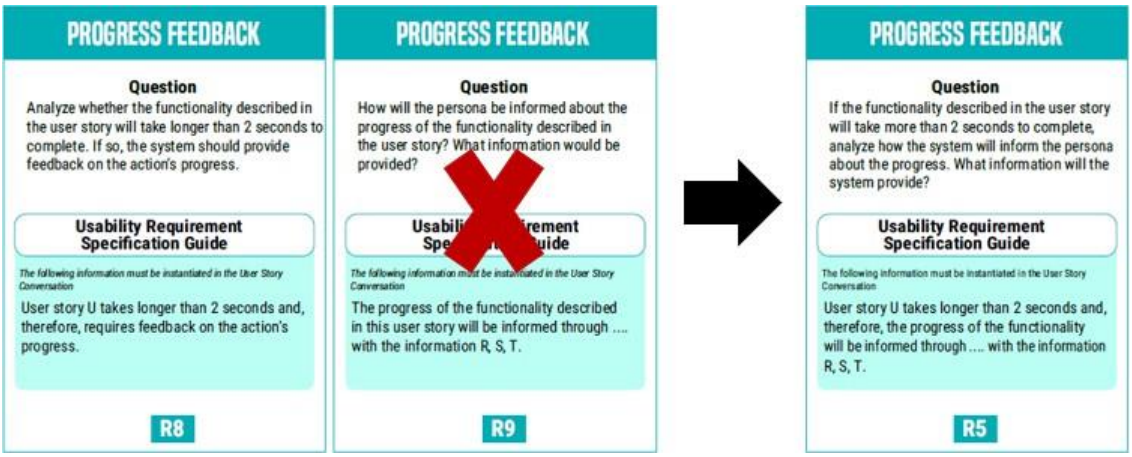

Figura 5. Result of cards review of the Progress Feedback mechanism.

Creation of a checklist: To better understand the usability mechanism cards, they were separated into four categories, as illustrated in Table 1. Based on the categorization of the cards, a checklist was developed to select appropriate cards for brainstorming. According to the persona and user story analysis, the checklist contains items to be checked, for example: *The functionality has relevant consequences for the persona.* If so, the related cards from the **Warning** mechanism should be considered while refining the user stories associated with this persona.

Creation of a board: To assist in organizing selected cards, a board was created to display the chosen cards (Figure 6). This decision should be made by consulting the categories (Table 1). For example, if the system fits into the *System Customization* group, then the Usability Requirements cards and Prototyping cards should be placed on the board in column *System Customization*. Thus, a subset of cards will be used in the brainstorming.

Updating the USARP adoption process: With the creation of the artifacts mentioned above, the USARP usage process has been updated (see Figure 7). The main changes are described below:

Selection of cards for brainstorming: This stage consists of analyzing and understanding the system's user stories and personas. After analyzing the user stories and personas, the usability mechanism cards are selected using the selection checklist.

Tabela 1. Items from the checklist proposed.

System Customization
( ) The persona wants to favorite elements or functions. **Usability mechanisms:** Favorites (M13) ( ) The persona wants to personalize the system. **Usability mechanisms:** Preferences (M11) and Personal objects area (M12).
System Feedback
( ) The functionality can affect the state of the system. **Usability mechanisms:** System Status (M1), Interaction (M2), Progress Feedback (M4). ( ) The functionality has relevant consequences for the persona. **Usability mechanisms:** Warning (M3).
User Control and Support
( ) The persona can cancel or undo actions. **Usability mechanisms:** Undo (M5), Abort operation (M6), Cancel (M7). ( ) The functionality involves different pages or user interfaces. **Usability mechanisms:** Go back (M4). ( ) The persona needs help with content to use the functionality. **Usability mechanism:** Multilevel help (M14).
User Data Input
( ) The functionality requires data in specific formats. **Usability mechanisms:** Structured text input (M9). ( ) The functionality requires different steps with data input. **Usability mechanisms:** Step-by-step execution (M10).

Organization of cards for brainstorming: Using the proposed board, the cards selected in the previous stage are positioned in the areas of each category (system interaction, input/output, preference) and compared with the user stories to validate the selected usability mechanisms.

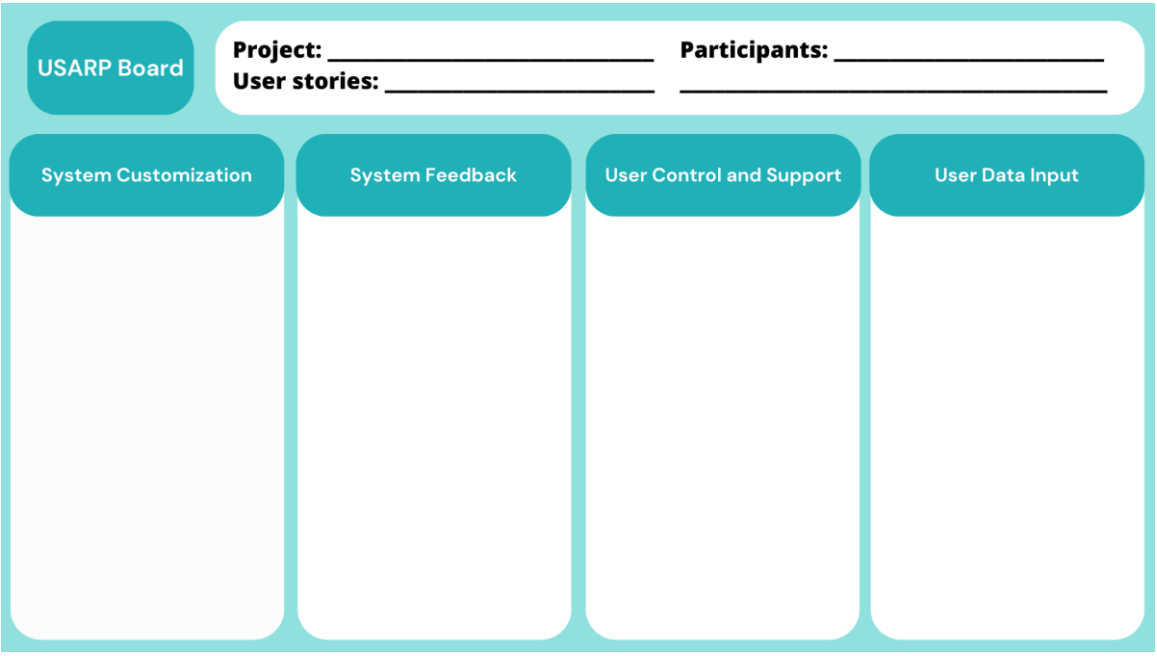

Figura 6. The USARP board to organize cards.

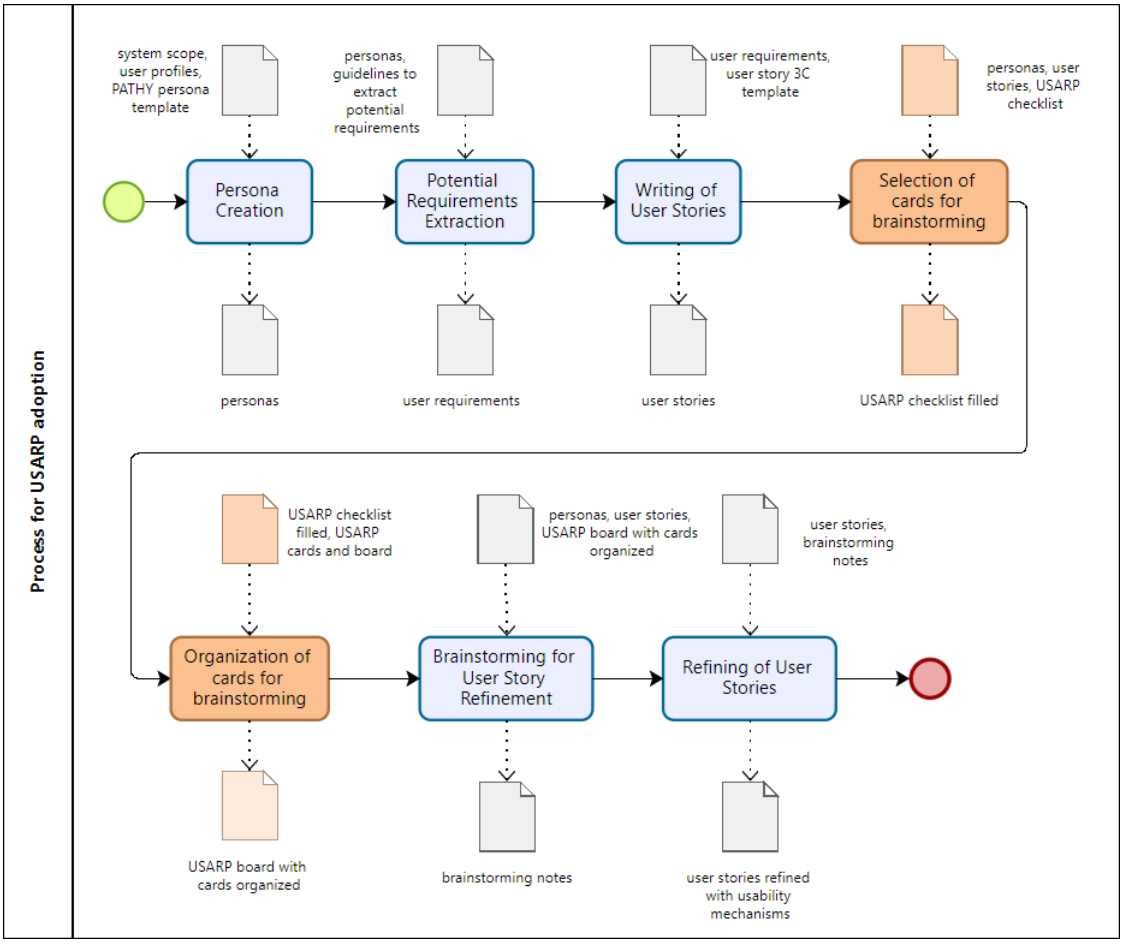

Figura 7. New version of the process for USARP adoption.

6. The new version of USARP in practice

This section presents a usage scenario of USARP for the refinement of a user story related to user account management functionality. The goal of the scenario is to exemplify the execution of the following activities in the USARP adoption process: Selection of cards for brainstorming, Organization of cards for brainstorming, Brainstorming for User Story Refinement, and Refining of User Stories (Figure 7).

Consider the user story: *"[US-20] As a user, I want to update my profile to keep my data up-to-date."* In preparation for refining the user story, the project team should use the USARP checklist to select the cards to be used during the brainstorming session. These decisions should take into account which usability mechanisms are relevant to the functionality described in the user story. In this example, the functionality relates to updating a user's profile. It's worth noting that there is no one-size-fits-all solution for filling out the checklist, as the decisions depend on the project scope, team knowledge, and user profiles. Table 2 provides an example of a filled-out checklist for this user story.

Based on the checklist, the project team can organize the cards for the brainstorming session. Each selected checklist item indicates which usability mechanisms are suggested for discussion. Therefore, Figure 8 illustrates the customized USARP Board based on the exemplified checklist.

Tabela 2. Example of a checklist filled.

System Customization
( ) The persona wants to favorite elements or functions. **Usability mechanisms:** Favorites (M13) ( ) The persona wants to personalize the system. **Usability mechanisms:** Preferences (M11) and Personal objects area (M12).
System Feedback
(X) The functionality can affect the state of the system. **Usability mechanisms:** System Status (M1), Interaction (M2), Progress Feedback (M4). ( ) The functionality has relevant consequences for the persona. **Usability mechanisms:** Warning (M3).
User Control and Support
(X) The persona can cancel or undo actions. **Usability mechanisms:** Undo (M5), Abort operation (M6), Cancel (M7). (X) The functionality involves different pages or user interfaces. **Usability mechanisms:** Go back (M4). ( ) The persona needs help with content to use the functionality. **Usability mechanism:** Multilevel help (M14).
User Data Input
(X) The functionality requires data in specific formats. **Usability mechanisms:** Structured text input (M9). ( ) The functionality requires different steps with data input. **Usability mechanisms:** Step-by-step execution (M10).

Brainstorming sessions can be conducted during user story refinement meetings to support sprint planning in Agile projects. Each brainstorming session can focus on one or two user stories. As the project team becomes familiar with USARP's questions, the sessions can be shorter, and discussions can flow more smoothly. This allows for a greater number of user stories to be discussed in a given time frame.

Guided by the questions presented on the selected cards for brainstorming, the

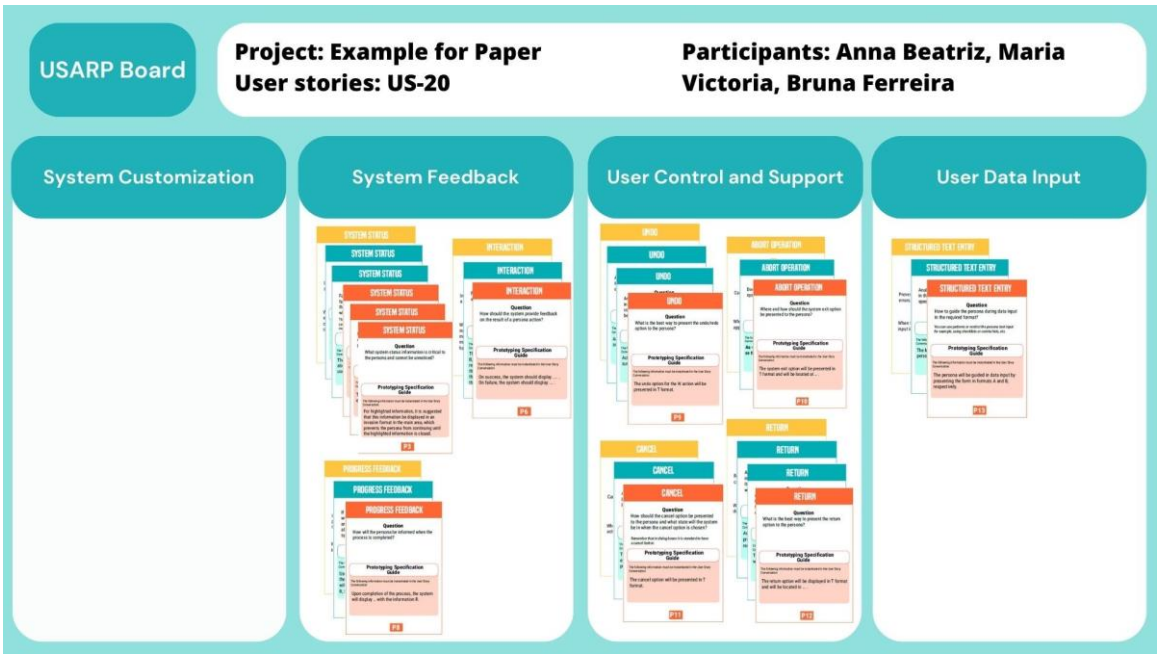

Figura 8. Example of a USARP Board in use.

project team can discuss how usability mechanisms can be provided by the user story. This decision depends on the project, so the cards do not have a right or wrong answer but provide the opportunity for the team to reflect on the questions and make decisions about usability aspects to be designed and implemented. Involving people with different viewpoints enriches the discussions and supports more informed decision-making. Some usability mechanisms that could be defined for user story US-20 are specified below:

- Undo
  Description: R10 - Profile updates can be undone/re-done through new data updates by the user.
  UI Specification: P9 - The option to update the profile will be available in the user's profile icon dropdown menu.
- Abort Operation
  Description: R12 - As a user, I want to log out of the system to protect my data.
  UI Specification: P10 - The option to log out of the system will be in the user's profile icon dropdown menu with the "Logout"option and an associated icon.
- Go Back
  Description: R15 - On the profile update page, the user can Cancel (return to what they were doing) OR Update.
  UI Specification: P12 - The Cancel option will be displayed below the data input fields, to the left of the Update button.
- System Status
  Description: R1 - The system status that should be reported are: (i) profile data has been updated.
  R2 - The system needs to provide feedback on connection failure, server failure, and database failure.
  UI Specification: P1 - The information to be displayed in the status area is "Data has been updated successfully."The highlighted information is "Unable to update data at this time, please try again later."
  P4 - Failure notifications will be displayed in the status area in red color with an error icon.
  P5 - Operation completion notifications will be displayed in the status area with a success icon.
- Interaction
  Description: R5 - During data entry, the system will indicate the focused field and button; upon successful profile update, the system displays the success notification and returns to the home page; in case of failure, the system displays the error notification and remains on the current page.
  UI Specification: P6 - In case of success, the system shows the feedback "Data has been updated successfully"; in case of failure, the system shows the feedback "Unable to update profile, correct information for X, Y, and Z."
- Progress Feedback
  Description: R8 - While the profile update is being processed by the system, the buttons remain inactive, and a spinner icon is displayed until the operation is completed.
  UI Specification: P8 - Upon completion of the process, the user will view the home page with diagrams OR an error feedback message.

- Structured Text Input
  Description: R17 - Data will be entered in the following formats: 1. Full Name: text only, no special characters or numbers; maximum of 100 characters; 2. Email: follow the format xxxx@domain; maximum of 100 characters; 3. Password: minimum of 8 characters; 4. Profession: a list with options: Student; Faculty; Researcher; Industry Professional; Other; 5. Institution: maximum of 100 characters.
  UI Specification: P13 - (1) In text fields with character limits (name, email, and institution), prevent the user from typing beyond the limit and display a red message below the fields if the limit is reached; (2) Email: if the user enters an improperly formatted email, display a red message below the field; (3) Password: if the user enters an improperly formatted password, display a red message below the field; (4) Profession: display a list of predefined options for selection.

The usability requirements defined for the user story can support various activities throughout the project, such as user interface design, specification of acceptance criteria, specification of test cases, implementation of usability features, and system validation with users. Development guided by usability requirements has the potential to prevent usability issues and promote higher usability quality.

7. Conclusions and Future Work

the system is processing the profile updateective use in usability requirements elicitation and specification. The research started with an exploratory study with a Software Engineering class, planning the exploratory study and analyzing the results. As a result, the redundant content of the cards was removed, and two artifacts were proposed for USARP: a checklist and a board that assists in selecting the USARP cards. Furthermore, an evolution of the process for USARP adoption was carried out.

It is hoped that artifacts will support the appropriate selection of usability mechanisms in the use of USARP, assisting in the agility of the requirements selection process. With more significant guidance in selecting the cards, planning brainstorming sessions for requirements elicitation becomes more efficient and adequate.

As future work, it is intended to investigate the use of USARP in new software projects. Thus, it will be possible to understand how USARP behaves in different environments and teams, exploring unique benefits for Requirements Engineering. In addition, it is intended to develop tool support for managing information collected during the adoption of USARP in brainstorming and usability requirement specification sessions.

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