Original Article

Mobile application Design to help People Suffering from Alzheimer's

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Abstract - Currently, people with Alzheimer's require special and full-time care, so they must prevent the person from being in danger. In recent years, the number of people suffering from the disease has increased. In addition, the fact that people who have Alzheimer's are characterized as having problems with their cognitive functions, memory loss, and personality changes affects large areas of brain certainty. For this reason, a mobile application was designed that will help stimulate and help people with Alzheimer's and responsible people or family members. Because you will be able to monitor where you are and choose the interactive games that you will have to develop your cognitive system, in addition, you will be able to make the application remind you of some people or objects that you have forgotten, for example, the virtual assistant will begin to read the things that you point in the module, as you can also have control of what time to take the medicines. In this work, the Scrum methodology was used for the development and the Figma tool for the design of the prototype. The results obtained from the research will be to have a better follow-up and to be able to help people with Alzheimer's in the cognitive system.

Keywords - Mobile applications, Figma; Scrum methodology, Alzheimer's.

1. Introduction

Many adults have Alzheimer's, which is normally related to the elderly, affecting adults and young people. In addition, it is known as a degenerative type that each time the patient worsens their health over time, and there is no cure. Therefore, the person must be very careful and always have help because they cannot do very easy things independently [1].

Alzheimer's is one disease that affects people's short-term memories and begins progressively and mildly. There are treatments to be able to delay, but there is no exact cure [2].

In the United States, more than 5 million have Alzheimer's disease, and it is estimated that in the year 2050, it may reach 14 million Americans who are older than 65 years may be living with the disease. Worldwide, it is estimated that there are 46.8 million people who are living with Alzheimer's disease. For people who are suffering from Alzheimer's disease, other people are needed, and many citizens provide their services that are not paid for their time. However, Alzheimer's disease is the sixth leading cause of death in people of all ages since it has increased by 89% [3].

In Peru, the adult population suffers from Alzheimer's, which can be represented by 70% of dementias, while 20% may be multi-infarct dementias. According to the statistics that are provided by the neurologist of the National Institute of Sciences and Neurology, 1% of the population of 60 years suffer from Alzheimer's in adults older than 60 to 65 years is 2%; while in those over 65 to 70 it is 4%; a percentage that rises to 8% if you are over 70 years old; while in those over 75 years of age it reaches 16%, for this reason, it states that it is a disease that is perceived in the behavioral disorder and currently people who have Alzheimer's live excluded from their homes and without any treatment that is adequate for they [4].

Cognitive impairment of multiple cognitive functions that people have and that affect memory is more likely to evolve into Alzheimer's disease. However, a percentage of the chronic forms are of discrete alteration that evolves [5]. Among the recommendations he gave was to be ordered. He explained that people with a low level of education, forgetful and distracted, have a greater probability of presenting the disease and presenting it more severely [4].

Positioning system technology that is global allows great changes in societies to occur. Applications that use GPS can constantly grow and become more and more indispensable in our lives because it is very useful for everyone. That is why it takes advantage of the low costs and evolution to be used

in favor. In addition, man has created innovations that are advanced in giant steps, allowing a clear disposition to improve the care of people [6].

Alzheimer's disease can produce a progressive disorder of the central nervous system. People directly affected may experience depression, anxiety, psychosis, and sleep disturbances [5].

The disappearance of memories and ceasing to make things necessary for one to live, such as personal hygiene, eating, remembering good times, and doing activities with family and friends, make people encrypt the disease both in its physical and physical aspects. Therefore, the process is very destructive for the people suffering from the disease and those around them [7].

The activities that can be carried out can be focused on or directed to the treatments of intellectual capacities that can be cognitively stimulated to the brain looking for healthy mental habits, and it is known that the human brain makes use of its neurons to access the information that is key for the development of the human being in his daily life, increasing brain exercise, at the same time the intellect and above all minimizing mental deterioration [8]

To solve the problem and have a better follow-up of people who have Alzheimer's, a good way is to use technology, according to the times we are in, which would be smartphones, since now everyone has a mobile device. For this reason, the application can help those responsible for having a better follow-up because it will allow them to have an interactive game to develop their cognitive system that is suitable for people with Alzheimer's; they can also have control of medicines, a reminder Of the people or objects that you want to remember, for example, there will be a virtual assistant that will say some things that the person has forgotten, in addition to having a section included where it will be possible to observe where the people with Alzheimer's are, and the person in charge will be able to see where they are. Find, seeing how far away the patient is.

The article's objective will be to develop a mobile application to improve the treatment of patients with Alzheimer's.

The rest of the document was organized in the following ways, section II will define the Scrum methodology and tools to be used, section III will show the case study, section IV will show the discussions, V will show the results, and finally, section VI will show the conclusion.

2. Literature Review

According to the author [9], The first symptoms that begin with Alzheimer's disease are often confused with old age or stress in the patient. A detailed neuropsychological evaluation can reveal mild cognitive difficulties up to 8 years before the person meets the diagnostic criteria. These early signs can usually affect daily life activities. The most notable deficiency is memory loss, which is manifested as difficulty remembering recently learned facts and an inability to acquire new information. Mild difficulties in executive functions: attention, planning, flexibility, abstract reasoning, or disorders in semantic memory, remembering the meaning of things, and the interrelationship between concepts can also be symptoms in the early stages of Alzheimer's. Apathy may appear, being one of the persistent neuropsychiatric symptoms throughout the disease.

According to the author [10], Alzheimer's disease affects the areas of the hippocampus, where memory formations and storage predominate in the mild stages of the disease in conjunction with the amygdala, which is responsible for the reasoning and processes that lead to deterioration of the synapse by the presence of the plates. The moderate stages affect the prefrontal cortex and the Tegmental pathway, manifesting alterations in the will and thoughts. Where it presents the condition of atrophies in the basal nuclei, as well as atrophy in the basal nuclei, it is also recommended to have good primary prevention must include good health habits, among them, a balanced diet and also help in the cognitive functions to be able to develop them.

According to the author [11], the patient who is suffering from Alzheimer's and does not have adequate treatment, the symptoms might worsen over time. Perhaps you cannot notice the possible signs of the illnesses of a loved one or acquaintances when you are in an early stage, but until the memory loss is severe, it becomes a warning signal. Currently, several sets of therapies are specialties to control the disease and prevent the advances of damage caused to the brain. Therefore, patients who suffer need to go to rehabilitation.

According to the author [12], patients with Alzheimer's affect their daily lives due to the limited consequences that the diseases produce because of pharmacological treatments, such as pharmacological (TNF). Where TNF exists, catalogs are therapies. In addition, there are multiple technological tools for the support of Alzheimer's patients, such as caregivers, that cover areas such as prevention, diagnosis, and treatment of diseases.

3. Methodology
3.1. Scrum Methodology
The SCRUM methodology is one of the many approaches for agile development. The SCRUM methodology is one of the many approaches for agile

development. SCRUM is simple when it comes to managing heavy projects of any kind. This methodology is one of the most powerful and famous companies chosen [13].

3.1.1. Sprint Planning

In this stage, the requirements or user stories developed during the Sprints are gathered and created [14].

3.1.2. Sprint Stage

Next, the sprint development is carried out, where the previously created requirements will be developed [15].

3.1.3. Sprint Review

The objective of this stage is to carry out the demonstration and review of the last sprint carried out, and, if necessary, the product backlog will be updated, including all the changes indicated during the review [16].

3.1.4. Retrospective

In this phase, once each iteration is finished, the product owner, scrum master, and development team meet to review how the team was and how they can improve for the next iteration [17].

Next, Fig. 1 shows the phases that make up the scrum methodology for developing a project.

Fig. 1 Release Planning in Scrum

Scrum focuses on project management in situations where long-term planning is difficult, with "empirical process" control mechanisms, where feedback loops establish the central element. A self-organizing team develops the software in sprint increments, starting with planning and ending with a comment [18]. Then, using the Scrum methodology in our project will make the application development an agile way, focusing on what is most important and making better monitoring that will be done to indicate the time spent developing the tasks used in each of them.

As shown in Fig 1, the stages developed concerning the research using the scrum methodology are explained [19].

3.2. Prototyping tools

3.2.1. Figma

It is a browser-based application used for UI/UX design that provides various tools for design, prototyping, and more. You can access Figma from both Windows and Mac OS as this is a browser-based application [20].

3.3. Technological tools for application.

3.3.1. Flutter

It is a cross-platform framework created by Google in 2016 publicly to create hybrid and high-performance mobile applications that can be executed on both Android and iOS [21].

3.3.2. Visual Studio Code

It is an open-source editor, very lightweight, but at the same time a very powerful editor; it has support for various languages and frameworks because it is cross-platform, and many Windows, macOS, and Linux users use it [22].

3.3.3. Firebase

It is a cloud platform for web and mobile applications, thus building high-quality applications. Firebase uses the JSON notation format to store data and provide a system used as a NOSQL database [23].

4. Case Study

In this section, the mobile application development will be carried out to aid people who have Alzheimer's. All this follows step by step the phases of SCRUM.

4.1. Sprint Planning

Next, the first thing to do is create a list of requirements necessary for the application.

❖ I want to enter user credentials to access the application and save my information as a user.
❖ As a user, I want to add memories to remember them in the future in case I forget them.
❖ As a user, I want a memory play area to remember playing.
❖ As a user, I want an emergency button that sends an alarm to my responsible person to warn him that I am in some danger.
❖ As a user, I want to add my medications and prescriptions to remember to take them at the right times.

4.2. Development Stage

4.2.1 Time estimation

In this phase, we will show the duration of each of the Sprints, as shown in Table 1.

Table 1. Duration of Sprint

Sprint	Story	Duration	Priority
Sprint 1	Conduct research on how to treat a person with Alzheimer's symptoms.	3 days	High
	Create access control to restrict people and identify them	2 days	Medium
Sprint 2	The system should allow both patients and caregivers to register.	1 day	High
	The system must provide those responsible with a configuration screen to restrict some patient games	2 days	Medium
	The application should allow saving reminders that help the patient to maintain memories in case of forgetting them	3 days	High
Sprint 3	The app should allow caregiver users to monitor the patient's location	5 days	High
	The system must show patients the location of their home	3 days	Medium
	The application should allow the patient to add the medications that the patient usually takes to make him remember and take them on time.	6 days	High
Sprint 4	The system must have selected games that help improve the patient's memory	6 days	High
	The application must include an emergency button to alert that it is in danger	4 days	Medium

4.2.2. Scope of the product

The estimated time it will take the development team to complete the story points, as you can see in Fig 2.
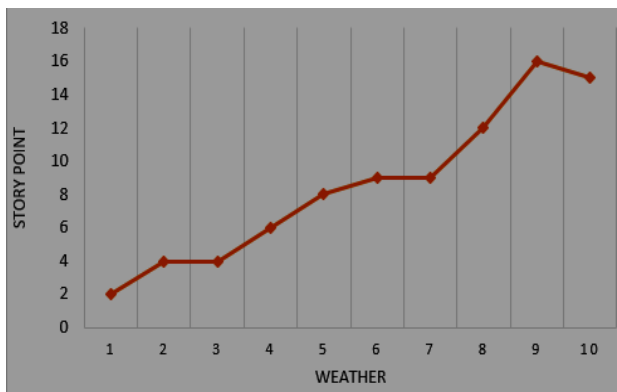

Fig. 2 Product Scope

4.3. Mobile Application Prototypes

At this stage, the prototyping of the application design to be developed is shown, detailing the functionalities in each module, as shown in Fig 3, Fig 4, Fig 5, Fig 6, Fig 7, Fig 8, Fig 9, Fig 10, Fig 11, Fig 12, Fig 13 and Fig 14.
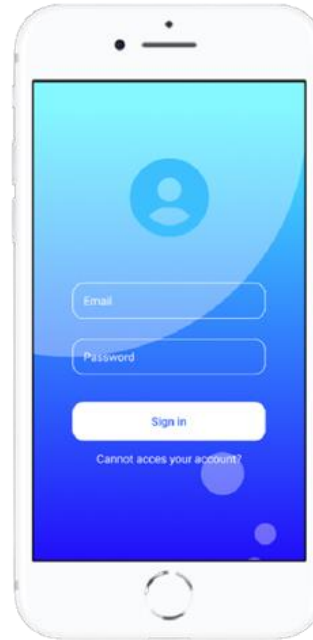

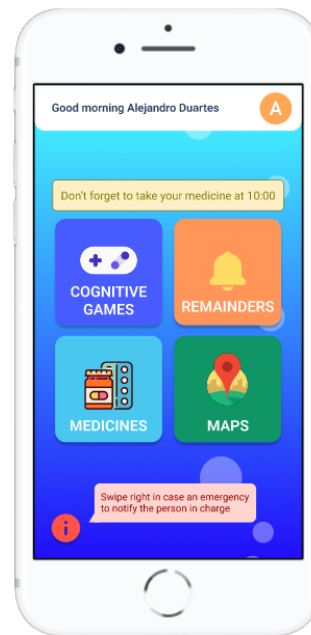**Fig. 3 Login Module**   **Fig. 4 Registration Module**
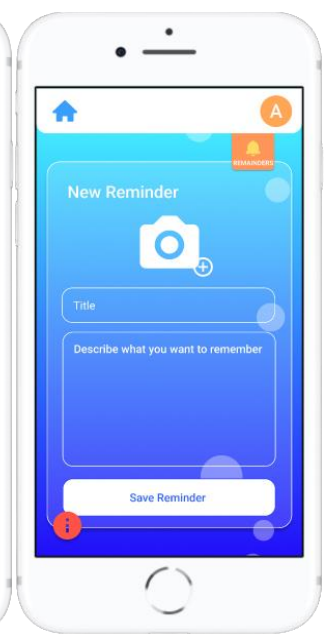

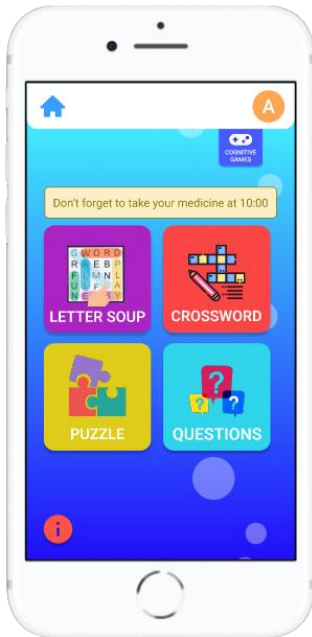**Fig. 5 Main Screen**   **Fig. 6 Add a Reminder**
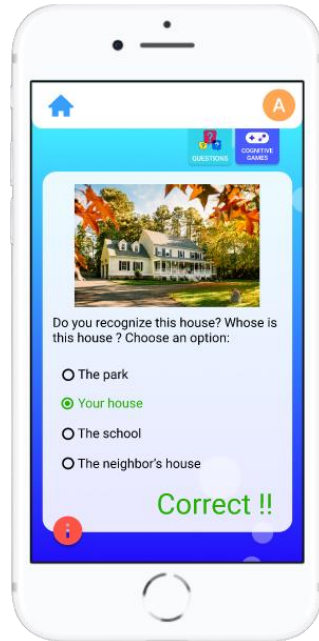
Fig. 7 Cognitive Games Area
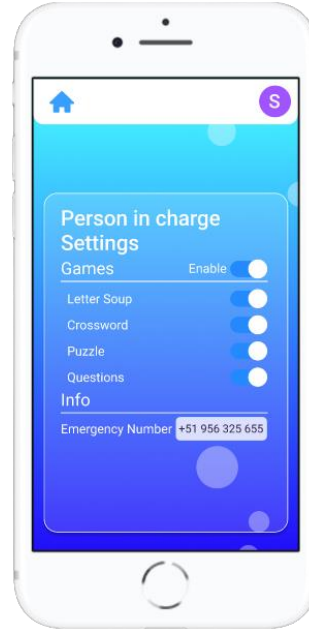

Fig. 8 Quiz Game

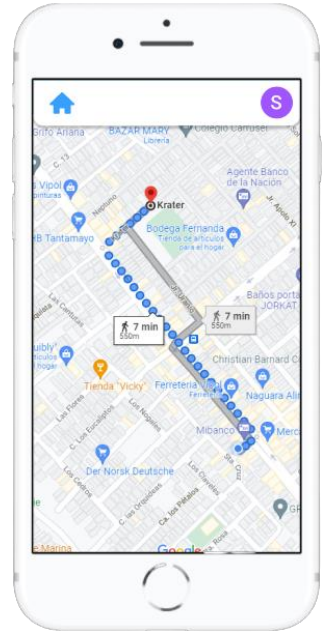**Fig. 11 Caregiver Settings Module**

Fig. 12 Real-time Patient Location
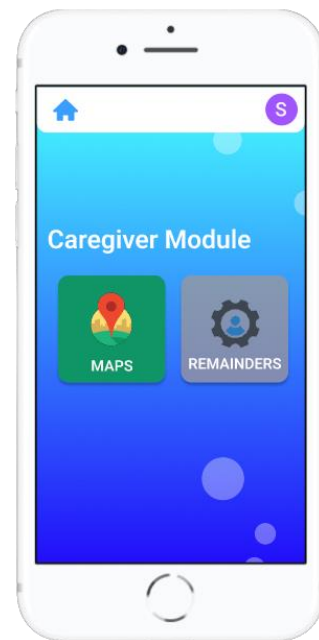

Fig. 9 Letter Soup Game
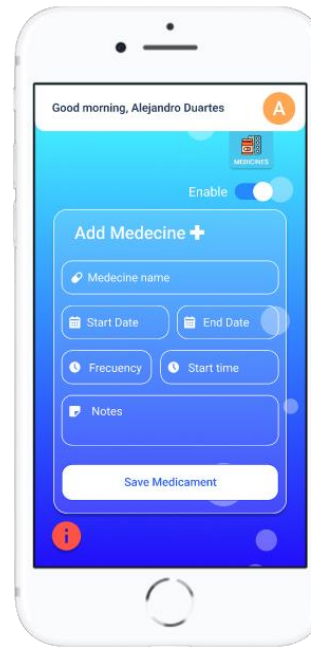

Fig. 10 Caregiver Module
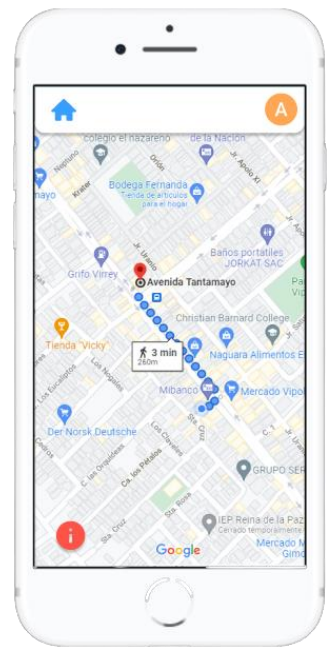

Fig. 13 Add Medicine or Prescription

Fig. 14 Location of the Patient's House

4.4. Increase of the mobile application modules

The following is to describe in detail the functions of the modules and their relationship with their respective prototype.

4.4.1. Increment 1: Login Module

In this increment, the home screen of the session is shown for all users; to enter, it must be previously registered, as seen in Fig 3.

4.4.2. Increment 2: Registration Module

In this module, you can find a registration area employing a form that will ask you to provide some data about the user, as you can see in Fig 2.

4.4.3. Increment 3: Main View Patient and Alert Module

In this module, the main screen of the patient's view is developed; here, you will find some options that will be useful, in addition to the implementation of an emergency button that will alert the assigned caregiver immediately in case of any danger as shown in Fig 5.

4.4.4. Increment 4: Reminder Logging Module

In this increment, a form is shown that allows to record reminders accompanied by an image in case the patient's condition becomes serious and he loses the patient's short and long-term memory, which will prevent him from creating memories; this is seen in Fig 6.

4.4.5. Increment 5: Cognitive Games Module

The present increment creates cognitive games that will help the patient improve memory, remember and recognize objects, places, and people, as shown in Fig 7, Fig 8, and Fig 9.

4.4.6. Increment 6: Caregiver Main View Module

In this module, the view of the caregiver assigned to the patient and their respective available actions are created that will allow him to know the location of the patient at any time, in addition to a special configuration of the cognitive games that are shown to the patient, this can be seen in Fig 10, Fig 11 and Fig 12.

4.4.7. Increment 7: Medication Management Module

With this increase, it is possible to add the medications prescribed for the patient, which will help through notifications and alerts when it is time to take the medications; this is shown in Fig 13.

4.4.8. Increment 8: Home Location Module.

This increment shows the location of the patient's home accompanied by a route and the time it will take to get home from their current location, as seen in Fig 14.

4.5. Sprint Review

Once a Sprint is finished, a meeting is held with the development team for 2 to 3 hours, depending on the number of weeks that the Sprint lasted. A team member evaluates the tasks developed and reviews whether it was accomplished or if any changes are needed. In addition to this, the SCRUM team members explain each process, and in case there have been any impediments during the Sprint, they must explain and what was the solution they took.

4.6. Sprint Feedback

The retrospective of the sprint is a meeting that occurs whenever you are going to finish a sprint, and this is used as a time to analyze what was done well during the previous sprint and what can be improved for the next sprint.

5. Results and Discussion

Next, the expected results obtained from the present research within the case study and the scrum methodology will be shown.

5.1. About the case study.

Table 2 shows the results obtained before and after the application was used for some time. It is observed that there was an improvement of 5% in patients in terms of subjective complaints.

Table I Absence of cognitive impairment after use of the app

GDS-1, Absence of cognitive impairment	Before using the app (%)	After using the app (%)
Absence of subjective complaints	80	75
Absence of obvious memory disorders in the clinical interview	80	75
Result	80	75

As a case study, the design of the screens for the mobile application was developed so that it is simple and interactive for the target user, enough so that training is not necessary to understand the functionalities. The Figma tool was used to create the prototypes since this tool gives us greater benefit and freedom when creating prototypes, unlike other tools.

In one article, a mobile app for cognitive stimulation was developed for adults who have Alzheimer's [24]. In contrast to the case study, an application was developed that, in addition to having an area dedicated to cognitive reinforcement for patients, also has access control to be able to restrict and identify the type of user who is accessing the application, so we can know if the user is the patient or the caregiver of the assigned patient.

Another study helps people diagnosed with Alzheimer's through a mobile app for Android and wireless data transmission devices called beacons [25]. This research

presents us with a system that provides management of medications, memories, and among others, the sending of the patient's location through beacons, unlike the case study proposed in this research that uses the telephone location services that are issued at all times to keep the patient's location information updated on the screen of the assigned caregiver.

5.2. About the Methodology.

When developing a project, various methodologies can help you manage it depending on the type of project. The scrum framework was improved for the present investigation, an agile methodology unlike traditional ones such as RUP or PMBOK. Compared to other methodologies such as Extreme Programming (XP), which is an agile methodology, it focuses on meeting the primary requirements of the customer [26]. Likewise, there is also the Kanban methodology, whose main purpose is to manage that tasks are carried out from beginning to end until they are completed [27]. The comparison of these agile methodologies can be seen in more detail in Table XVII.

Table 3. Difference Between Scrum, Extreme Programming and Kanban

Feature	Scrum	Extreme Programming	Kanban
Development Approach	Iterative and incremental	Task flow development	Short iterations
Team Collaboration	Cross-functional teams	Self-organizing teams	The team comprises specialized resources
Sprint Duration	4 weeks	1 to 3 weeks	Continuous flow
Assigned Role	3 pre-defined roles: Product Owner, Scrum Mastery Development Team	No prescribed roles	No prescribed roles
Process Ownership	Scrum Master	Team ownership	Team ownership
Requirements Management	Requirements Managed in the form of artifacts through Sprint Backlog and Product Backlog.	Managed in the form of Story Cards	Managed using Kanban Boards
Product Delivery	Delivery as per time-boxed sprints	Continuous Delivery	Continuous Delivery
Changes During Iteration	Not Allowed	Allowed	Changes allowed at any time

6. Conclusion

People with Alzheimer's disease in the mild phase are presenting symptoms that can be confused with age since they forget small things. In contrast, in the moderate phase, the symptoms are more visible by relatives with sudden mood swings due to not being able to remember or do certain things that they used to do easily. For this reason, it is very important when starting with cognitive stimulation from the mild phase to delay cognitive deterioration.

Through the results obtained from the application for patients with Alzheimer's in light and moderate phases, it can be determined that the app being developed is one of the additional aids for older adults or young people who are suffering from the disease and will help their caregivers, since the user can keep his mind active, remembering tasks that will be notified by the application and stabilize in constant mental exercise without the need for a caregiver present, in addition, the caregiver will be able to see where he is because he will also have his module where You will be able to see how far away you are, if you will get out and also what games you can use so that you cannot get stressed easily.

For future work, it is recommended that they make a chatbox connected with the doctors who are specialists in people with Alzheimer's for better control and that some of the questions had been personalized.

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