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TECHNOLOGY****FAMILY AND SOCIAL REINTEGRATION GAMIFICATION FOR THE ELDERLY****Andressa da Silva Costa Belo ^{*1}, Luciano Vieira Lima**^{*} Eletrical Engineering, Federal University of Uberlandia, Brazil

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ABSTRACT

This article presents a set of design in Quiz format for Smartphones set up for the gamification of elderly Effective Learning Reinforcement, in order to reintegrate them to their family and social environment. This study is based on theories such as the 'Forgetting Curve' created by Hermann Ebbinghaus and the teaching-learning theories named 'Structured Knowledge Maps', 'Effective Exponential Memory Method in Binary Base' and 'Effective Memory Curve. The main goal of this article is to demystify the vision that several people have of elderly, a vision of inability, disinformation, disrespect, contempt, etc. and insert a game that can be used by the entire family in order to help the elderly .

KEYWORDS: gamification, elderly, memory, effective learning.**I. INTRODUCTION**

Nowadays we can see the growing focus of studies, services and products aimed at the elderly. This focus is due to the fact of the great growth of the elderly population. According to the World Health Organization, we are undergoing an unprecedented demographic transformation, in which people over 60 years of age had a remarkable and higher growth in relation to the other age groups [10][9] [1].

Several studies [3] [10] [12] show that despite the historical struggles and acquired rights, the elderly are still a minority discriminated by society in many aspects. One of them, conducted with the elderly and not elderly, indicates that 80% of the elderly surveyed confirmed that there is prejudice against old age and 85% of non-elderly confirmed as well. Negative aspects such as disrespect, contempt, disinformation and disability were negative factors pointed out by the elderly and not elderly about the image that young people would have of aging[3].

In aging, the social circle of people changes. The elderly often relate only to the family and often becomes a 'burden' for them, who stop seeing the elderly as an active person with opinions that matter and start to see him or her as an old person who does not remember the conversations, the relatives, is unaware of the new technologies, that is, they need to be constantly taught and reminded of the same things, frustrating both the elderly and their families. But people should ask themselves: Is the elderly disabled, uninformed and forgotten or do they just lack the reinforcement of learning that would be required to memorize it?

According to Hermann Ebbinghaus's Forgetting Curve, all individuals have a large percentage of forgetfulness at the end of the whole learning process, starting significantly after 20 minutes, that is, what actually remains in memory is only a small portion of the information previously presented [7]. So, we ask ourselves: if the family only allows a few days of the month to visit and talk with the elderly, how can the elderly person remember everything they talked about, what are the younger family relationships, what are their children's jobs, each grandson's names, how to use the newest smartphone model if that information is not reinforced in the right time? The elderly person is reminded of facts present almost daily in his routine, such as newspapers or novels, for example. But how to know the right time?

According to studies [10] [2] there is an Effective Memorization Curve that uses tools called Structured Knowledge Maps (SKM) and Effective Exponential Memorization Method in the Binary Base (EEMMBB) that, together, maximize and potentiate the learning and memorization processes, showing how and when to reinforce the knowledge learned so that it is memorized more effectively.

II. SKM AND EEMMBB

The Structured Knowledge Maps (SKM) start from a simple concept that can be translated into a question: How to start the process of information / teaching to a person? The answer would be: from zero, from the most basic, that requires no prerequisite for the person to start without any psychological barrier or cognitive gap.

It is clear that this answer depends a lot on each person, even when two people are the same age, having taken the same courses, read the same books and lived in the same family. The knowledge already acquired by a person depends on the interest each had and how much effort and dedication was devoted to learning what was being taught. At the moment, the SKMs that, prior to the beginning of the presentation of a new knowledge, are able to make a qualitative evaluation through the analysis of Qualitative Assessment Tables (QAT) [2] carried out by a computer system or even by a (Teacher, tutor or the student himself). This resource allows, from the QAT of certain knowledge to be transmitted, identify what is missing to the student to be able to initiate a certain learning [10]. Identified cognitive gaps (doubts of necessary pre-knowledge), the system, the method, suggests, leads the student to prepare to start learning without barriers, without prior ignorance. Satisfaction is not excess of knowledge but lack of ignorance.

Thus, SKMs start from a minimal knowledge, initial to be transmitted, for example, in the case of the elderly, self-knowledge of the skills and competences they had (or still have), then the family relationship between them, children and grandchildren, Social relations (friends, neighbors, ...), then the purchasing power and cost of basic inputs used daily (price of bread, milk, medicine), then social and political relations, etc. One should imagine this knowledge as a ray of a circle and the area formed by this ray as the area of ignorance formed by such knowledge [10] [2].

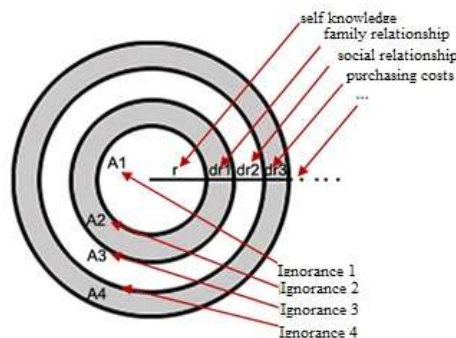


Figure 1. Structured Knowledge Map, Knowledge Rays and their Areas of Ignorance

One should have only one knowledge at a time, especially the elderly, not for the inability to learn, but for the absence or infrequent reinforcement of the knowledge imparted. According to the forgetting curve [11], if it takes a week to reinforce learning, it is only retained in memory at around 9%. This causes the feeling of misunderstanding in the family, caregivers and professionals that the elderly person is experiencing learning difficulties when, what most of the time occurs is that the learning reinforcements were not performed at the correct time intervals [10]. Thus, the more different knowledge is delivered, the more cognitive overload may occur, which, in addition to hindering the acquisition of knowledge [4] [8] [5], requires more reinforcement in the short term, which usually does not occur. It is common to experience a relay between family and caregivers of the elderly, where each introduces new information and new knowledge, without a structure of fixation, reinforcement, of what has already been reported, ministered.

A methodology for fixing content by temporal reinforcement in effective intervals of maintenance of knowledge in long-term memory, used in this work [10] is the EEMMBB. It uses a mathematical rule for learning reinforcement, determined by the maximum interval that a knowledge should be reinforced: the LRI - Learning Reinforcement Interval = $2n$, where n ranges from 0 to 14 for someone who has a life expectancy in around 100 years. This means that the same person does not need to remember more than 14 times of acquired knowledge at 4 years of age (considering the life expectancy of 100 years). In the case of the elderly, over 70, the maximum n can be adopted as 12, that is, retention for another 24 years. Obedience to this relation of a conceptual reinforcement in intervals of time, in $2n$ days, ensures that the reinforced memories will be memorized by the elderly permanently and cumulatively.

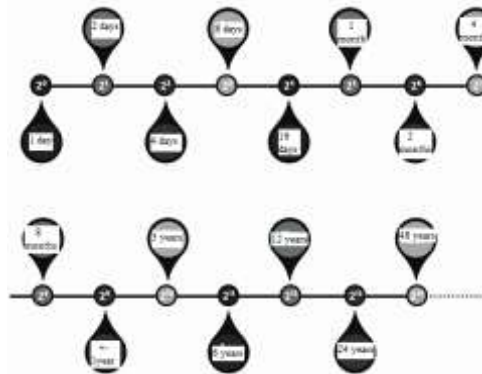


Figure 2. Effective Exponential Memorization Method in the Binary Base (EEMBB)

III. THE QUIZ GAME IN ENHANCING EFFECTIVE LEARNING AND QUIZ DESIGN STRUCTURE

The game is being designed using the App Inventor tool, developed by Google, which allows the creation of applications for Smartphones. We chose Smartphones to insert the reinforcement of effective learning in the so-called mobile learning, a new paradigm of education created by mobile technologies [6]. The game was developed with Quiz format to facilitate the verification of correctness and errors about reinforced knowledge, since it is one of the main forms of objective evaluation used in the scope of teaching-learning.

The application is intended for easy manipulation, without prior programming knowledge, by people such as the elderly themselves, caregivers, family members and friends who take turns caring for the elderly.

This process of gamification aims at allowing even younger people to become interested and involved in the process of reintegrating the elderly relative into the family and social environment, since young people are very much identified with the different forms of technology, which can bring two generations together that "normally" would not have common interests.

The Quiz is being designed to have five screens, the first 'Quiz 2n' (Figure 3), is the initial screen in which the user will be able to create and edit a quiz, create and access the quiz schedule and play a quiz saved previously.

The creation and editing screen (Figure 3), the second screen, will allow the family member or caregiver to create a quiz to reinforce the knowledge acquired by the elderly, edit to adapt the information reinforced when necessary or even delete it.



Figure 3. Initial Screen of Quiz 2n and Editor Screen, creating a new Quiz (example of Self Knowledge reinforcement)

The third screen, Quiz Schedule (Figure 4), is being designed in order to apply the Learning Reinforcement Interval of 2^n already explained in the SKM and EEMBB section. After the user choosing the first day of playing the reinforcement game, that is, $n=0$, the app will automatically set the other dates to follow the LRI correctly, so that the family member, caregiver or the elderly themselves can follow the right dates for the effective learning.

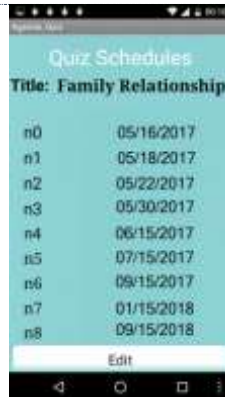


Figure 4. Screen Quiz Schedules with an example of dates set up according to the Learning Reinforcement Interval of 2"

After creating and setting up the quiz schedule, it will be time for playing! The elderly will be able to play the quiz made by the family member or caregiver as many times he or she wants and checks if the answer is correct right after choosing (Figure 5). The last screen is the Game Over screen, that will display the score achieved in each play with the according number of stars (Figure 6).



Figure 5. Quiz Screen (example of Family relationship and Purchasing Costs knowledge reinforcement)



Figure 6. Game Over screen (example of score that can be achieved when playing)

The app will have an additional settings part in the Editor Screen in which the user will be able to choose between two models of quiz, with 4 and 8 questions. Besides, the user will be able to enter messages of correctness and error that will be displayed when the elderly check the answer and the family member or caregiver will be allowed to choose between different rewards for the Game Over screen.



Also, it will be set up several alarms so that the user or elderly can be reminded on the correct date in order to maintain the Learning Reinforcement Interval and have a more effective learning.

IV. CONCLUSIONS

The application is being thought of in a simple, generic and that serves the purpose of each user, that is, it is designed to be customizable to meet the specific learning reinforcement needs of each elder, since each one has a unique family and social environment divergent from other possible users. In addition, the quiz format stimulates the user to want to achieve better scores and stars. Besides, this format also allows the same question to be asked in different ways, with humor and different resources, reinforcing the information without the disadvantage of the repetition and seriousness of traditional evaluations.

We hope that in the future the Quiz app can be helpful to demystify the vision that many people have of the aging process and that they can look at the app, based on the Structured Knowledge Maps and Effective Exponential Memorization Method in the Binary Base, as an alternative for aging more mentally healthy, increasing their independence and family and social relations. Furthermore, we hope that people who have old family members can read this paper and think about the questions that have been raised about the elderly and realize that yes, they can help them to be reintegrated in their family and social environment applying the theories addressed in this paper.

V. REFERENCES

- [1] A. C. L. F. Camacho and M. J. Coelho. "Public policies for the health of the elderly: a systematic review"; *Brazilian Journal of Nursing*, vol. 63 no. 2, 279-84, may/april. 2010.
- [2] D. C. M. Ferreira et al. "Structured knowledge maps: proposal for a new methodological approach for teaching and learning"; *Educare et Educare Magazine*. vol. 09 505-514, jul./dec. 2014.
- [3] D. S. e Silva et al. "Long-Term institution for the Elderly: Reports and Reflections"; *Revista Eletrônica Management & Health Eletronic Magazine* . Vol. 06 No. 02, 1679-1688, 2015.
- [4] J. Medina. "Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School."; Pear Press. 2009.
- [5] J. Sweller. "Evolution of human cognitive architecture"; *The Psychology of Learning and Motivation* (B. Ross), Vol. 43, 215-266, 2003.
- [6] M. Vieira, E. D. G. Alves. "Celphone and classroom: from limits to possibilities."; *Annals of Computer Science Workshop at School*, 236-245, 2015.
- [7] M. A. B. M. N. dos Reis. "The Memory of Witness and the influence of Emotions in the Collection and preservation of Evidence.". PhD in Health Sciences and Technologies. University of Lisbon. P. 389, 2014.
- [8] N. Cowan. "The magical number 4 in short-term memory: A reconsideration of mental storage capacity"; *Behavioral And Brain Sciences*, Vol. 24, 87-185, 2001.
- [9] W. H. Organization (WHO) (1998), Pan American Health Organization (PAHO): Resolution CE122.R9, Senior's Health. 2002.
- [10] R. B. Filho et al. "Knowledge maps and permanente memorization of knowledge and learning: a proposal of new tools in the rescue of the elderly self-esteem and citizenship."; *Univap Magazine*, Vol. 19 No. 33, 52-67, 2013.
- [11] T. O. Nelson. "Ebbinghaus's contribution to the measurement of retention: Savings during relearning." ; *Journal of Experimental Psychology: Learning, Memory, and Cognition*. Vol. 11, 472-479, 1985.
- [12] V. de F. Nascimento Junior and T. N. Russo. "The Brazilian state and the fundamental guarantee of a dignified aging."; *Annals of the Brazilian Congress of Collective Process and Citizenship*, No. 3, 243-248, Qct 2015.

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