*Corresponding Author's Email: flabasouza@yahoo.com.br
Proceedings of the International Conference on Future of Business, Management and Economics
Vol. 1, Issue. 1, 2024, pp. 1-11
DOI: https://doi.org/10.33422/icfbme.v1i1.540

ISSN: 3030-1084 online

Diamond Scientific Publishing

Inova Lab Una -Financial Education: Proposal Based on Teaching, Mobile App and Augmented Reality to Raise Awareness and Financial Control

Flávio H. B. d. Souza*, Leandro F. d. Carmo, Joice M. Miranda, Gabriel R. Vieira, Felipe R. Vieira, Kenner H. M. Rodrigues, Leandro C. A. d. Oliveira, Felipe P. Menezes, Vinícius S. Bernardes, Ana C. T. Cunha, Rafael A. Fonseca, Bárbara L. Gama, Pedro T. Figueiredo, João G. d. O. S. Xavier, Douglas F. Martins, Thiago B. Matoso

Inova Lab UNA Centro Oeste – UNA – Brazil

Abstract

The Brazilian population demonstrates a low level of financial planning, which results in financial problems, unpayable debts, credit restrictions and problems that result in a low quality of life and access to resources. This issue also implies unfeasibility for investments, such as education and professional development. Currently, new laws have been instituted by the Brazilian government, promulgating this approach in basic education. Economics was brought into educational institutions among the cross-cutting themes. This paper aims to present the development of an educational solution of an application for teaching and practicing financial education based on schools. Based on development in mobile solutions, with foundations in financial education and scoring in pedagogical terms, an app with capabilities and information that are weighted by teaching and finance was built. In its implementation methodology, tools such as BPMN (Business Process Model and Notation) and an Adapted Canvas were used to define the project scope. An experimental process with AR (Augmented Reality), for an initial evaluation, connecting a gamified and playful association for the efforts of users to be connected. This first stage of the research aims to academically substantiate and demonstrate the foundations of this solution, which is mainly aimed at Brazilian public education, which is so lacking in investments and accessible tools to optimize the learning of its students.

Keywords: financial education; Brazilian students; mobile solutions; augmented reality; public education

1. Introduction

Brazilian school education has been submitted to a significant change during the COVID-19 pandemic, since 2020, due to the mandatory internet's consumption and other technological devices as a study platform to guarantee the education's access (Buda & Czekman, 2021). A markable sudden change in teaching resources by referencing the article by Freitag (2017), which portrays the resources most taught by the interviewed teachers, in which it was observed the absence of use concerning the advanced technology instruments such as applications, games or research, that is, teaching tools that require the use of a technological device during classes.

However, the pandemic's occurrence compelled schools to adapt to the virtual resources to enable its students to continue their studies remotely, which triggered continued training for educators regarding the technology they should manage in classes. Moreover, the technology's consumption by the education sector has not been finished with the pandemic absence.

According to De Almeida et al. (2023), new technological didactical resources were necessary in a study environment, due the world's social and economic changes: a new teaching-learning process is required as a way of enhancing the cognitive skills of students. Technology is not capable to guide an educational process in a guideless path, it is aways required interactions between teachers and students. To provide benefits of a new learning methods, moreover the student autonomy, new technological resources require the educator's know-how to teach them appropriately, to help students in handling them, that is, the government needs to develop a continued training plan involving Information and Communication Technologies, so that classes can be performed with no limitations due to lack of knowledge of how manage a device or software.

A practical example of resource to be observed in continuing education process is the Chat GPT®, an AI (Artificial Intelligence) capable of assists both student and teacher (in the classroom or not). Notoriously, the Chat GPT's using process generates controversy, however, if a pedagogically based utilization has been made, benefits can be achieved such as: teachers could prepare various teaching materials, as well as lesson plans and the student could visualize the resolution of accounts, understanding the step-by-step operation, correction of essays, generating questionnaires to study for assessments, among many other features that can be explored (Guimarães, et al, 2023).

A substantial set of technologies permeate the possibilities of computational solutions, and they are available to both society and academia. Among those possibilities, this research demonstrates a mobile application (app) solution (i.e., focusing on software aimed at smartphones) associated to Augmented Reality (AR), where computational elements will interact between the real environment and graphical interactions according to the stimuli and environment elements. A demonstration of the prototype is presented in this paper trough organizational tools, such as Canvas and BPMN (Business Process Model and Notation).

The main objective of this paper is the mobile solution development's presentation. The software has the theme of management and financial education, associated to augmented reality for optimize the teaching-learning of students in Basic Education. As specific objectives to guide the research process and project: the solution flows were modeled based on an adapted canvas tool and BPMN, followed by the process of evaluation and prototyping, through MVPs (Minimum Viable Product), with experimentation through AR and, a pedagogical evaluation (Santos et al., 2022). This research is justified since it is noted that

Brazil presents a substantial dysfunction in financial learning - according to the Central Bank, 64% of Brazilians do not have control over their finances (Banco Central do Brasil, 2018).

2. Materials and Methods

2.1 Theoretical and Frameworks References

The solution's development was supported by a concept's referencing research. Firstly, the financial education's, in the Brazilian scenario, was observed. According to Da Costa et al. (2023), financial education is a continuous learning process. The individual builds capacity and responsibility for their savings, as well as autonomy in managing their assets and accounts. The project aims to engage students to improve their behavior about the financial education concept, encouraging in them the continuous habit of planning accounts and bring an evolution process to the managing their finances. According this prerogative, concepts about tools to align the main objectives e using flow of the mobile application solution were selected. Those modeling tools should be understandable to a multidisciplinary development team, so they were chosen: Canvas (specifically: the adapted version used by Santos et al., 2022) and BPMN.

The Business Model Canvas is a tool used to describe building, analyzing and business models. The adopted version to plan the mobile solution is described in Santos et al., 2022, with variables pertinent to the construction of software of this type, identifying the necessary points to execute the project, the pros and cons of the same, among other information of utmost importance for the progress of this research. This Canvas model uses questions which can be summarized into 4 large groups: Blue - App (Mobile Application) General Objective, Green - Contributions and Dataset; Yellow - Challenges and Risks and, Purple – Problem's references.

According to Choudhary & Riaz (2023), BPMN brings the ability to describe the process of using the App and its representation in a standardized and accessible format.

As the analysis methods for the mobile application design process were defined, two essential bases were referenced:

- **Mobile Solutions:** resources to be used to build and manage applications, such as games and other software, aimed at operating on cell phones (mobile), which is the focus of the project (Boduch & Derks, 2020).
- **Augmented Reality (AR):** a technology to enable integration of virtual/digital elements into the real world, interacting as the same through the camera or sensors. For the developed mobile solution, AR is a playable character that will help the student to manage their finances, enabling them to check whether a product that was shown on television fits within the individual's budget, just by pointing the camera at the television. and this responds in an integrated way to the expense organizer, checking its savings (Geroimenko, 2020).

Such references supported this research.

2.2 Implementation Methodology

The research proposal is based on a following process: surveying demands and needs for the solution, modeling and development of the software and an analysis of the pedagogical contributions that the solution can bring to the students.

A pre-project was previously developed, performing a market study, listing similar applications. Thus, three steps were followed to develop the solution:

- **Stage 1 - The Adapted Canvas Analysis:** where a preliminary modeling of a solution based on a mobile application was developed, evaluating concepts such as: objectives, contributions, risks and scientific foundations.
- **Stage 2 - Process of Structuring and Software Modelling:** the application structure was developed, as well as the graphical interfaces and functionalities. At this point, the processes were outlined to define the content that would be present, the users who would interact and the interaction strategy with Augmented Reality (AR) to increase the engagement of the target audience.
- **Stage 3: Pedagogical evaluation:** A pertinent issue was the evaluation of the pedagogical potential in assessing the project on the students, as its contribution focuses on the process of optimizing the knowledge of young people and children about financial resources.

These steps focus, summarily, on the modeling, implementation and analysis of the proposed solution, focusing on a tool for engaging and strengthening knowledge and care for a healthy financial life, focusing on the Brazilian population.

3. Results and Discussion

3.1 Analysis of the Adapted Canvas

Firstly, through the adapted canvas, concepts to present the mobile solution's objectives were synthesized, based on the theoretical framework also described therein, as well as risks and challenges, becoming a core reference for the other App development stages (Figure 1).

Figure 1: Canvas Adapted from Application Modeling

What types of users will be on the project?

The application will be used in a school setting, with its users being students and teachers.

What use cases will be in the project?

Customer needs: usage for pedagogical purposes, as well as achieving financial balance, making financial education their ally for savings and better autonomy in financial management.

Expected tool contributions:

- The application will develop new features according to the user's age group;
- The tracks are released according to the teacher's management.
- Initially, the app would be based on financial education, as well as tabs for entering the user's income and expenses.
- From a certain age, the teaching function about the world of investments is unlocked: notions about what stocks, cryptocurrencies, income, risks, among others, are;
- Upon reaching adulthood, the user will have the option to follow long-term or daily (day trading) investment tips;
- Challenges and games for all ages.

General purpose of the app/system:

Assist users in financial management and education aspects for pedagogical purposes, as well as providing expense organization to help users understand where their money is being spent.

App/system challenge and risks:

- Not achieving engagement;
- Keeping users engaged in the proposal.

Challenges and risks of the data analysis that will be made possible:

- Data Protection Law (LGPD);
- Distribution and processing carried out in the app's database.

What statistical and strategic analyzes can be done using the app/system:

- Number of users by age group;
- Users per class/group;
- Activity reports per class/group;
- Article readings;
- Income vs. Expenses per user;
- Savings goals;
- Profits vs. losses from investments.

Challenges and risks of the tool(s): Compatible platform and programming tailored to the envisioned usage.

What data is managed in the project?

Full name, email, date of birth, school name, class, among others.

What work are related to this proposal?

SANTANA, Mathews Raphael Vieira et al. UMA VISÃO PSICANALÍTICA SOBRE EDUCAÇÃO FINANCEIRA INFANTO-JUVENIL. **Anais do EVINCI-UniBrasil**, v. 3, n. 1, p. 284-284, 2017.

PRADO, RS de. **Educação Financeira no ensino fundamental I**. 2013. Tese de Doutorado. Dissertação–2013.

Scientific references for the problem:

SOUZA, Matheus Gabriel Nascimento. **"NÃO VEJO FUTURO!"**: a carência de Educação Financeira Escolar para Jovens e Adultos. 2022. Trabalho de Conclusão de Curso.

DE CARVALHO, Josimauro Borges; DE SOUZA PEREIRA, Andreza. Uma revisão integrativa sobre a importância da educação financeira considerando os reflexos da pandemia de covid-19. **Journal of Education Science and Health**, v. 3, n. 1, p. 01-11, 2023.

Scientific references for the tools:

PONTES, Aldo Nascimento; TOMAZELA, Maria das Graças Junqueira Machado; ALVES, Danilo Cardoso. Nico: aplicativo para auxiliar na educação financeira de crianças do ensino fundamental. **Refas-Revista Fatec Zona Sul**, v. 4, n. 1, p. 19-31, 2017.

MARIANO, Kathleen Diniz; FERNANDES, Carolina Martins; DOS SANTOS, Juliana Casarotti Ferreira. Educação financeira infantil: forma criativa de educar. **ETIC-ENCONTRO DE INICIAÇÃO CIENTÍFICA-ISSN 21-76-8498**, v. 16, n. 16, 2020.

Template desenvolvido por
Prof. Dr. Flávio Souza **Lattes:** http://lattes.cnpq.br/4111795897515753
Profa. Msc Rafaela Moreira **Lattes:** http://lattes.cnpq.br/1207202817257723
Profa. Dra Samara Leal **Lattes:** http://lattes.cnpq.br/4919443884503279

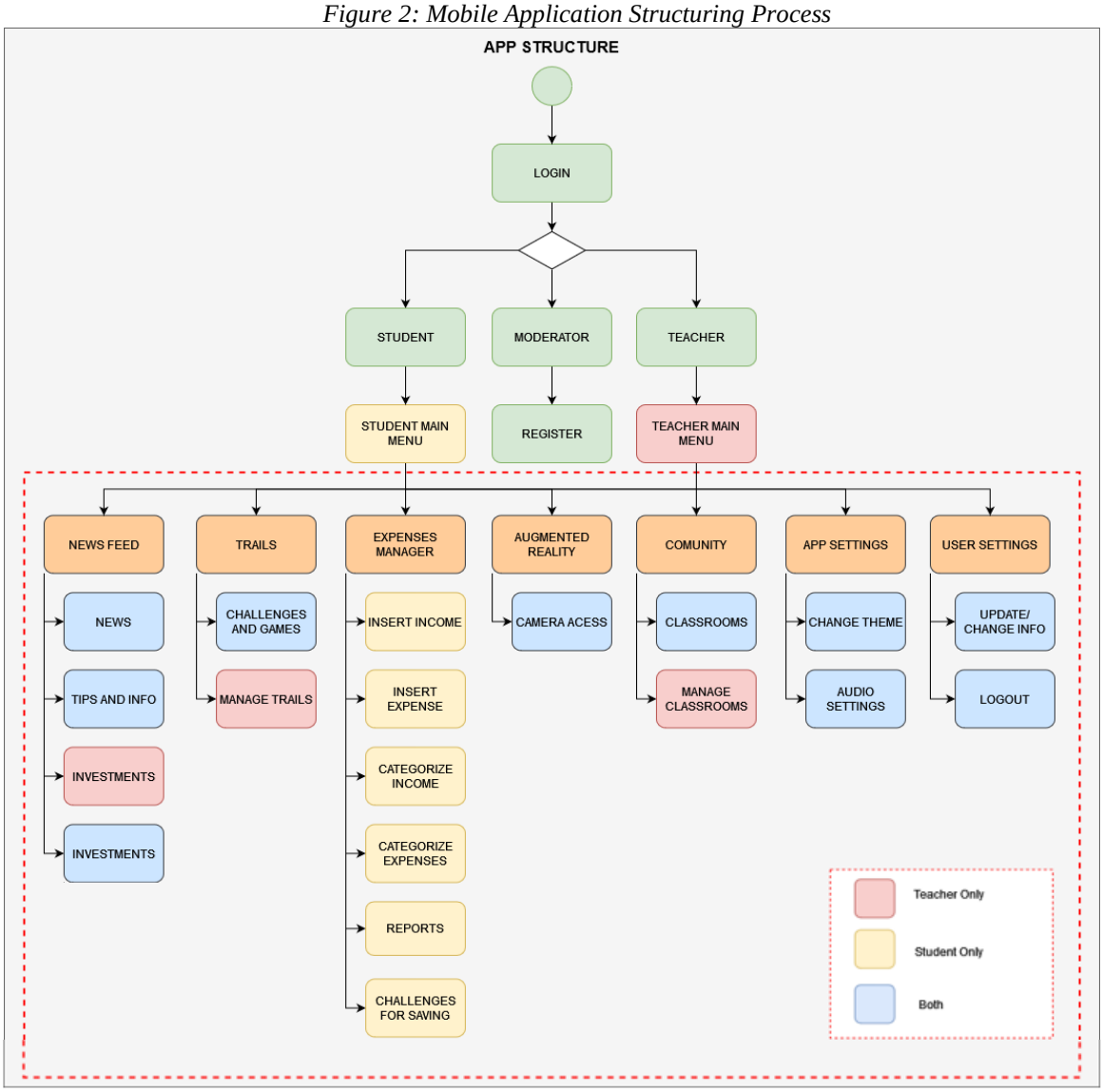
Source: (Authors, 2024)

The blue group summarizes the general objectives of the mobile solution and guides it towards a main purpose: it states that the application's goal is to assist in a pedagogical way in the financial management of students, combining theory with practice, making it not just static teaching, but rather dynamic, with the ability to involve new generations. The purple group presents the references that guided and provided the theoretical foundation of the Canvas base. The green group details the components that will be necessary to begin the application's scope and its contents, such as: target audience, requirements to be solved, as well as the contributions to the user. Finally, the yellow group demonstrates concerns about the project, listing possible challenges and risks in different areas, such as tools (compatibility between systems such as iOS® and Android®), data analysis, due to laws and integration with a database. data and other obstacles that could affect the application being created.

3.2 Process of Structuring and Software Modelling

After planning the adapted Canvas, an organization was created for the mobile solution organization, described in Figure 2.

Figure 2: Mobile Application Structuring Process

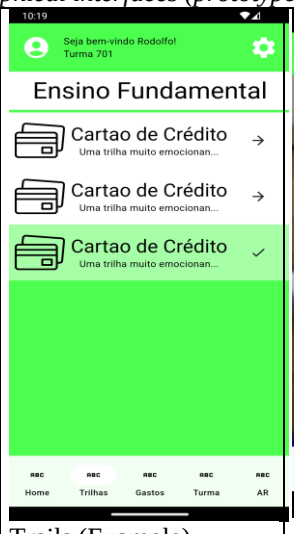
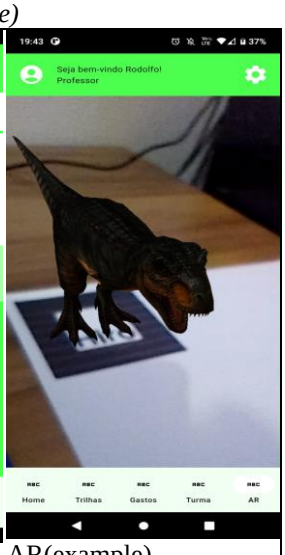


Source: (Authors, 2024)

This structure demonstrates the application organization. Three profiles are used: teacher, student or moderator. In short, both teacher and student will be able to access all modules of the systems. However, the teacher will be able to insert and edit trail content, create classes and manage students. The student will be able to consume the content that the teacher inserts, watch news, participate in trails and classes that the teacher makes available.

The MVP was build, by the modeling of the application's graphical interfaces (screens), as can be seen some samples in table 1.

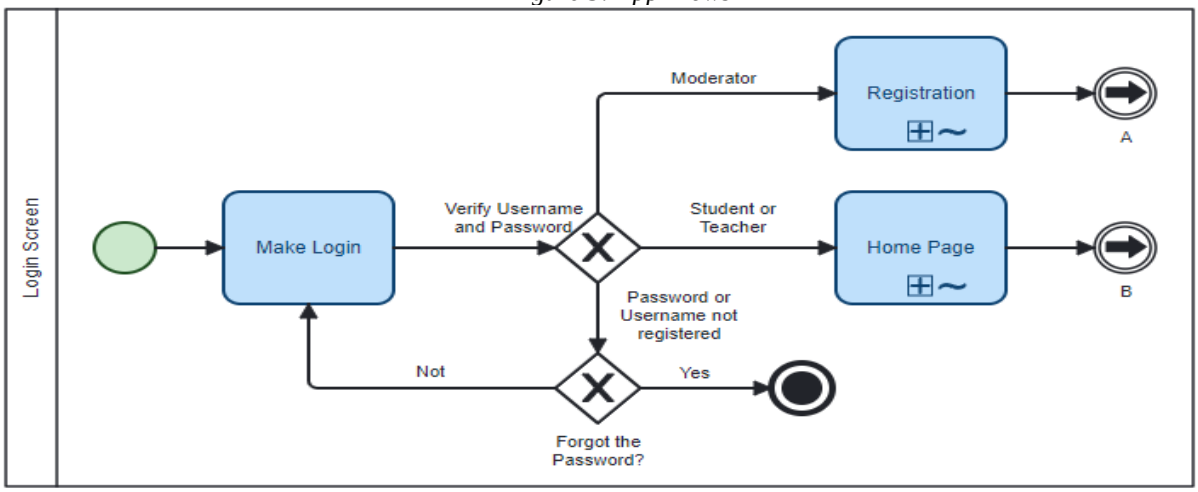
Table 1: Screenshots of graphical interfaces (prototype)

			
Login (Example)	Home Page (Example)	Trails (Example)	AR(example)

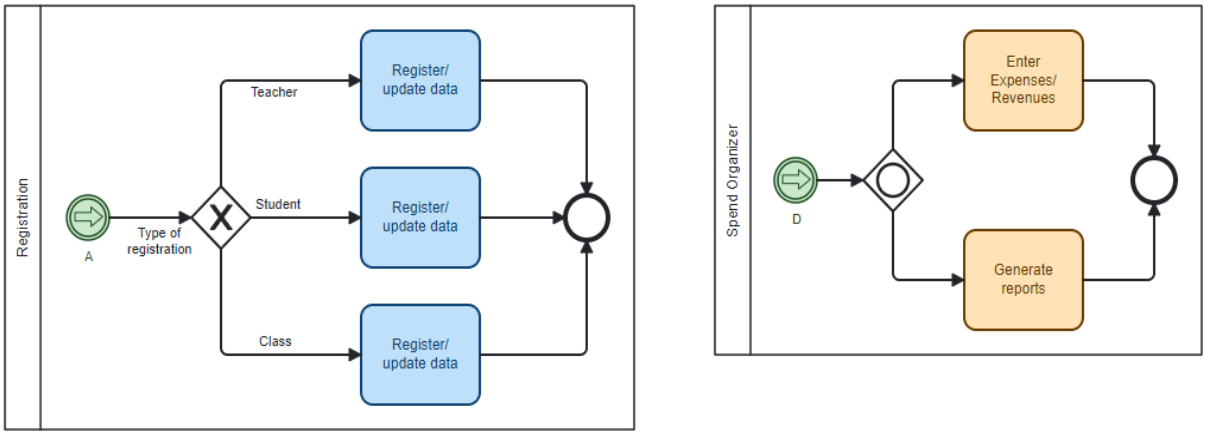
Source: (Authors, 2024)

The interaction flow between graphical interfaces and functionalities is described in Figure 3.

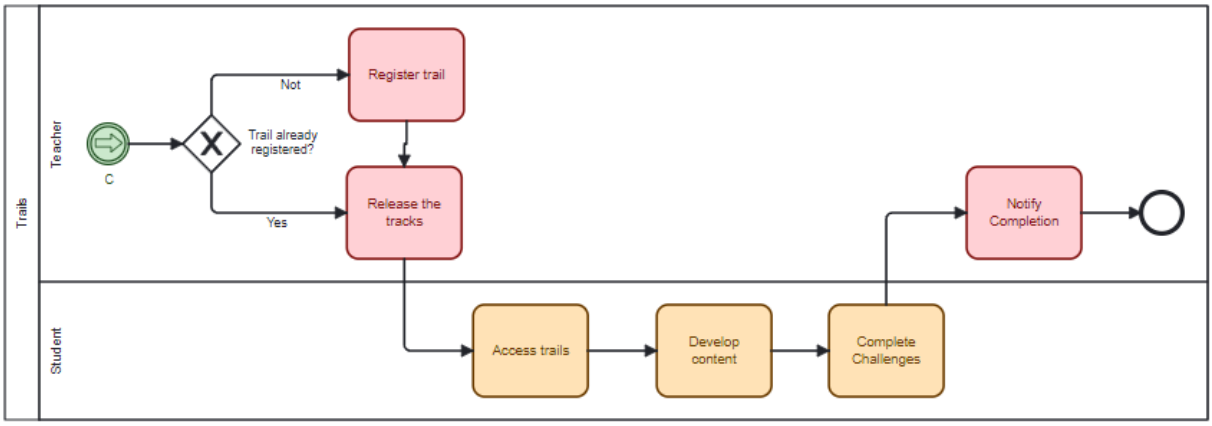
Figure 3: App Flows



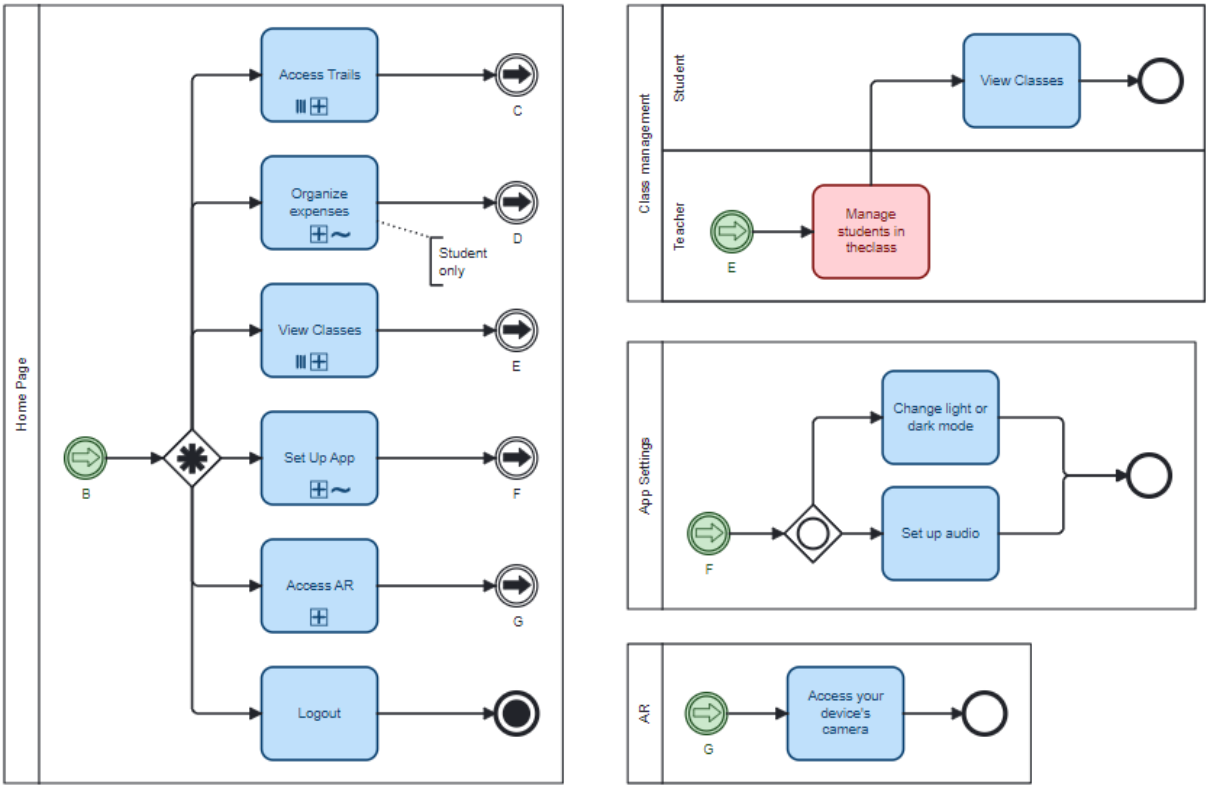
Flow 1 (User login and registration process)



Flow 2 and 3 (User Registration Process/Organizer Processes)



Flow 4 (Trail participation process)



Flow 5,6,7,8 (Process of using Home Page menus/ Process of managing a class/ Process of changing app settings/ Process of using AR)
Source: (Authors, 2024)

According figure 3 description and the samples in table 1, the following topics describe the application sectors:

- **Feed and News –** This tab consists of a space for news, updates on what is happening in the financial market and the global economy, as well as forums and other information that moderation publishes, in addition to the section on investments;
- **Trails –** Learning trails are available. However, it is possible for teachers to create their own playable trail for their students. Furthermore, trails also contain challenges and games, where the teacher can apply the ones that are already ready in the app with the students, as well as create their own personalized challenge, being able to assign a grade to their students;
- **Expense Organizer –** A practical part of the application, where both students and teachers can monitor their savings, entering their income and expenses, categorizing them;
- **Augmented Reality (AR)** – This tab is integrated with the expense organizer. Its main function is to analyze, through scanning images using the cell phone camera, whether the product the user wants to buy fits within their budget and whose response will be carried out in an animated way by a character, in order to reach and engage the public as well. children when using the application;
- **Social** – The teacher and students can access the class tab, where they can communicate via messages when interacting with the icons of other users, and the tab is used to control students by the teacher;
- **App Settings** – This tab contains layout changes that the user can make with the app (Dark Mode), as well as audio settings, to reduce or remove the app's sound;
- **User Settings** - In this tab it is possible to carry out registration updates, as well as log out of the application, and then access another account through it.

In short, the software seeks to provide learning trails about financial control, news and educational questions about financial issues. Together with the application in AR, the proposal to bring knowledge and engagement to students is consolidated.

3.3 Pedagogical evaluation

Financial education within the school environment was implemented as a mandatory transversal theme, which can be referenced in different curricular components, from elementary school to high school. The application was built to aim a fundamental educational tool for learning theories and practical applications in a school environment.

A earling learning about financial management appliaed to younglings can bring the possibilites to a generation aware of its finances and economic power, with a strong adherence to the responsibility of its own savings, making it a more prudent and cautious society with its income and expenses.

With the mobile solution developed by Inova Lab UNA in Divinópolis-MG, it is possible to combine theory and practice within the same App. It will be through it that thousands of students will be able to access various content focused on the area of economics, finance, investments, knowledge about payment methods and their advantages and disadvantages, among other topics that help them become more critical young people when it comes to using their finantial resources.

Furthermore, a survey performed in Brazil, presented on the website of the Ministry of Education (MEC), already shows that students participating in projects related to financial education increased the level of their savings by 1%, with 21% of students organizing their expenses in lists and 4% negotiate prices and payment methods when making a purchase (Lima et al., 2022).

Throught a solution available for the entire educational enviroment, the amount of children and teenagers that the application would reach would be even greater. Thousands of students with free access to a teaching platform that will transform their financial and personal lives, acquiring autonomy and greater responsibility towards your assets, capital and expenses, generating the sense and duty to save for a greater objective or for emergencies where there is a need to spend in the future.

Finaly, the conscious use of money, promoted through solid financial education from childhood, can bring countless benefits to Brazil. From increasing savings and investments, to reducing debt and empowering individuals, to the positive impact on the national economy and the formation of more responsible citizens, the positive effects are vast and profound.

4. Conclusion

Financial control of young people in the contemporary world, a truly plausible challenge, with consequences that can act, including in social expectations. This paper described and evaluated about the financial education's current situation, within schools and its impact on Brazilian society. The mobile solution promoted by this group is a fundamental tool to engage and foster the economy, autonomy and conscious management since childhood, working within the school environment.

The social demands, specifically new methods to bring students to engage and interact with educational technologies, are a real e actual challenge. It's an ultimate goal present methodologies where the youth can understand complex concepts in a playful way, to apply what they learn with the application in practice.

Therefore, it is suggested as the next step to implement the application in a school environment, promoting and expanding access to financial education, with education being a right established for all citizens, conferred by the Brazilian Constitution of 1988 and perpetuated in the law of guidelines and bases, in which refers to transversal themes, the teaching of which has become mandatory.

References

Banco Central do Brasil [Brazilian central bank]. Portal BCB [Portal Brazilian central bank]. Available in: https://www.bcb.gov.br/detalhenoticia/200/noticia (Access in 29 may 2024).

Buda, A. and Czékmán, B. (2021) Pandemic and education. Central European Journal of Educational Research, v. 3, n. 3, p. 1-10.

Boduch, A. and Derks, R. (2020) React and React Native: A complete hands-on guide to modern web and mobile development with React. js. Packt Publishing Ltd.

Choudhary, R. and Riaz, N. (2023) A business process re-engineering approach to transform business process simulation to BPMN model. Plos one, v. 18, n. 3, p. e0277217.

Da Costa, G. Al., Alves, S. M. C. and Carvalho, L. M. R (2023) The Sociocultural Conception in Financial Education: A Critical Look at the Consumerist Society [A

Concepção Sociocultural Na Educação Financeira: Um Olhar Crítico À Sociedade Consumista] *Cenas Educacionais*, v. 6, p. e16291-e16291.

De Almeida, L. M., Torres, C. I. D. O., Seixas, N. R. D. M., Dos Samtos, D. B. and Da Silva, C. D. D. (2023). The importance of information and communication technologies in the teaching and learning process in science [*A importância das tecnologias da informação e comunicação no processo de ensino e aprendizagem em ciências*]. *Ensino de Ciências e Tecnologia em Revista–ENCITEC*, 13(2), 54-71.

De Carvalho, J. B. and Pereira, A d. S. (2023) An integrative review on the importance of financial education considering the consequences of the covid-19 pandemic [*Uma revisão integrativa sobre a importância da educação financeira considerando os reflexos da pandemia de covid-19*]. Journal of Education Science and Health, v. 3, n. 1, p. 01-11.

Freitag, I. H. (2017) The importance of teaching resources for the teaching-learning process [*A importância dos recursos didáticos para o processo ensino-aprendizagem*]. Arquivos do MUDI, v. 21, n. 2, p. 20-31.

Geroimenko, V. (2020) Augmented reality in education. Cham: Springer, 2020.

Guimarães, U. A., Brandão, C. A., Daitx, M. A., de Arruda Dutra, A. F. G. and Lopes, V. R. B. (2023). Digital Media in the Educational Field: A Look at the Applications of GPT Chat in Education [*As Mídias Digitais No Campo Educacional: Um Olhar Pelas Aplicações Do Chat GPT Na Educação]*. *RECIMA21-Revista Científica Multidisciplinar*-ISSN 2675-6218, 4(7), e473556-e473556.

Lima, A. A., Siqueira, S. W. M. and Nunes, M. A. S. (2022). The Relevance and Relationship of Computational Thinking and Financial Education in Brazilian Basic Education: A Survey on the Understanding of Pedagogy, Degree in Mathematics and Education Students [*A Relevância e a Relação de Pensamento Computacional e Educação Financeira na Educação Básica Brasileira: Um Levantamento sobre o Entendimento dos Estudantes de Pedagogia, Licenciatura em Matemática e Educação*]. In *Anais do I Workshop de Pensamento Computacional e Inclusão* (pp. 151-162). SBC.

Mariano, K. D., Fernandes, C. M. and Dos Santos, J. C. F. (2020) Children's financial education: creative way of educating [*Educação financeira infantil: forma criativa de educar*]. ETIC-Encontro De Iniciação Científica-ISSN 21-76-8498, v. 16, n. 16.

Prado, R. S. d. (2013) Financial Education in elementary school I [*Educação Financeira no ensino fundamental I*]. 2013. Doctoral thesis.

Pontes, A. N., Tomazela, M. D. G. J. M. and Alves, D. C. (2017) Nico: application to assist in the financial education of elementary school children [*Nico: aplicativo para auxiliar na educação financeira de crianças do ensino fundamental*]. Refas-Revista Fatec Zona Sul, v. 4, n. 1, p. 19-31.

Santana, M. R. V., Knupp, F. F., Sroka, F. H., Ferreira, C. C. S. and Mallmann, L. J. (2017). A Psychoanalytic View on Financial Education for Children and Youth [*Uma Visão Psicanalítica Sobre Educação Financeira Infanto-Juvenil*]. Anais do EVINCI-UniBrasil, v. 3, n. 1, p. 284-284.

Santos, A. L. F., Silva, B. G. P., Lacerda, E. A. S., Andrade, G. F. D., Oliveira, G. A. G., Lourenco, I. H. A., Alves, L. L. F., Campos, S. E., Flor Junior, A. C. G., Santiago, H. L. P. and Souza, F. H. B. (2022). High and Higher Education Associates to Meet Market Demands: A Case Study of the Brazilian Health Sector in the City of Lagoa da Prata. In: 4th International Conference on Modern Research in Education, Teaching and Learning,

2022, Barcelona. Proceedings of The 4th International Conference on Modern Research in Education, Teaching and Learning.

Souza, M. G. N. (2022) "I DON'T SEE THE FUTURE!": the lack of School Financial Education for Young People and Adults [*"NÃO VEJO FUTURO!": a carência de Educação Financeira Escolar para Jovens e Adultos*]. Undergraduate thesis.