



SUNRISE App: A tool to validate the characteristics of an infocommunicational model capable of potentiating social and emotional education for high school students

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Abstract

This paper discusses the design and evaluation of a prototype (SUNRISE), a proof of concept of a digital platform capable of representing an info-communication model to potentiate Social and Emotional Education (SEE) applications. Contextualized by the theoretical background, a taxonomy is proposed with categories related to organizing the classification of SEE apps. The FIGMA prototype integrates 4 use case scenarios and the corresponding user narratives, tested at José Estêvão of Aveiro School Cluster with a sample of 16 subjects. Secondary school teachers and senior high school students performed user experience (UX) and usability tests (May 2024) of the prototype and revealed evidence of pertinence related to the prototyped model's characteristics. Qualitative data also highlights the relevance of the crucial model's elements and guidelines that can in fact be facilitators of specific SEE application usage.

CCS Concepts

• Human computer interaction (HCI); • Human-centered computing Collaborative and social computing; • Applied computing Education;

Keywords

Prototype Development, Infocommunicational Model, Social and Emotional Education, High School

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1 INTRODUCTION

Part of the work reported in this manuscript integrates the SUNRISE project (Soft Skill UNDERstanding, Recognition and Promotion In School Ecosystems) that uses digital technological mediation solutions (applications and platforms), to promote the identification and improvement of social-emotional competencies in non-higher education ecosystems. The characteristics of the "future-ready human" [1–3] and the need to strengthen the power of transformation of society establish Social and Emotional Education (SEE) as a strategy of extreme relevance for the well-being of citizens and the promotion of characteristics that help in a structural change of society for a resilient future [4–6] especially in Portugal [7, 8]. The theoretical framework determined the so-called "valley of social and emotional competencies" age [9] the interest of this group in more challenged-based learning scenarios [10] and the potential of using dynamic activities to fulfill this need [11]. The purpose of this study (SUNRISE) is focused on identifying the characteristics of a technology-mediated solution (application) to potentiate social and emotional learning. In other words, an app that can bridge



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this gap to identify specific applications (within a specific taxonomy) for the myriads of needs in social and emotional learning (as competencies).

We address in this paper the project's theoretical background and the relevant technology mediation characteristics – as a representation of an info-communicational model, which is needed to potentiate SEE, its first version as an application prototype (SUNRISE App), and the evaluation it went through in an educational ecosystem with teachers and students.

This document is organized into five sections which include: a theoretical contextualization, classification (taxonomy) of the indexed apps, a review (benchmarking) of applications for SEE purposes, the design and evaluation of the SUNRISE App at *José Estêvão de Aveiro* High School. The qualitative evaluation data, collected from the 16 participants, reveals strong evidence of adequate contributions to foster learnability and efficiency. Besides this, participants' opinions also reveal that the prototyped application includes a good use of elements such as gamification; community usage validation; indexation and categorization of SEE applications, and artificial intelligence to suggest SEE apps, as relevant characteristics of the SEE promotion model.

2 THE “FUTURE-READY HUMAN” EDUCATION

Social and Emotional Education (SEE) is a broad theme within the theory related to education, especially in the school environment where it is referenced in the curricula of several countries, particularly Portugal. SEE is considered an indispensable tool for exercising full, active, and creative citizenship in the information and knowledge society [12]. This set of social and emotional competencies is given many different names, such as soft skills, human competencies, or transversal skills [13], and it should be considered a complex structure related to the concepts of social and emotional intelligence and development.

The “future-ready human” follows a set of virtues, among them, the most relevant perspective of social and emotional competence is how the individual can determine future goals and commit to them, what the OCDE [1, 2] and UNESCO [3] call “student agency” and suggest that with community commitment it is possible to achieve well-being in 2030.

The SEE has produced several frameworks for its visualization. CASEL - The Collaborative for Academic, Social, and Emotional Learning [14] is a widely known and implemented worldwide framework that determines the five broad and interrelated areas of competencies: i) self-awareness; ii) self-management; iii) social-awareness; iv) relationship skills, and v) responsible decision-making [15]. The SEE can support society's structural shift towards a resilient future [4–7], strengthen a central goal of a more functional society [13]: through a belief that emotional and social literacy reduces violence, improves adaptive capacities, and provides the foundation for healthy learning and development [16].

The purpose of education is to empower children to be lifelong learners and effective citizens [1, 2]. Historically, school educators have been particularly sensitive to the fact that emotional and social learning provides the platform for learning how to learn and the development of self-reflection, responsibility, caring, cooperation, and

effective problem-solving [3, 16]. And over the past two decades, the understanding of how essential these skills are and how we can integrate them more effectively into the academic context has been clearer [14, 15].

In education, it is relevant to start by clarifying that the enumeration of these competencies does not presuppose any internal hierarchy between them. None of them, on the other hand, corresponds to a specific curricular area, and in each curricular area, multiple theoretical and practical skills are necessarily involved. “The development of multiple literacies, such as reading and writing, numeracy, and the use of information and communication technologies, which support learning and maintaining the lifelong learning process” [8, p.19].

In this sense, we consider the information paradigm and the new technological moment [12] a way of understanding how to increase productivity using technology and strengthen integration to transform society: “In a virtuous circle of interaction between knowledge and the application of technology, to create a more advanced generation of knowledge and information processing.” (p.41-42)

The technology comes as an improvement to bridging this gap with various possibilities to the school environment and to the student developing competencies in an autonomous way, especially during high school years. Therefore, the process of finding a solution that is already done for the SEE may not be as easy, since the educational apps available are somehow short of competency building [17]. In this sense the development of a model and application of characteristics such as gamification, role-playing, social responsibility, and community building, among others [11, 12] where features desired to create a solid opportunity to solve a gap of SEE is an opportunity that has arisen with the SUNRISE app.

The creation of the prototype aims to collect opinions of teachers and students on the competency building of social and emotional competencies and engage both target audiences to potentiate these practices in the classroom environment, but also outside of it.

In Portugal, the pillar that determines the strengthening of social and emotional competencies in the school environment and provides the alignment of curricula and activities in the classroom is the Profile of Students Leaving Compulsory Education – called PASEO in Portuguese [8]. The document is structured in Principles, Vision, Values, and Areas of Competence and determines what young people are intended to achieve at the end of compulsory education, accompanied by the commitment of the school and all those who work there (meaning teachers, managers, policymakers, families, tutors and all those who, directly or indirectly, have responsibilities in education). It presents a framework that guides decision-making in the scope of curriculum development, consistent with the vision of the future defined as relevant for the Portuguese youth (p.9-10).

From this conceptual base, a visual symbolic and integrated representation of SEE in Europe, Portugal, and CASEL (Fig. 1) was developed by the authors to support a relational analysis between what is stated by the SEL methodology, and the Portuguese and European (EU NESET Framework for Social and Emotional Education). This analysis served as a base to consolidate the knowledge used for the classification (taxonomy) of the selected mobile applications.

According to Hirsh-Pasek et al. [17], there are four dimensions to consider in *educational apps* to be aligned with known processes

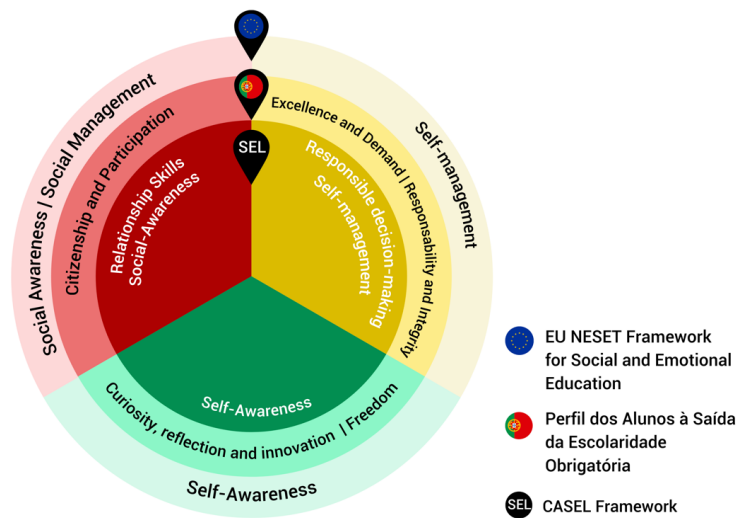


Figure 1: The holistic chart - a visual symbolic and integrated representation of SEE in Europe, Portugal and in CASEL

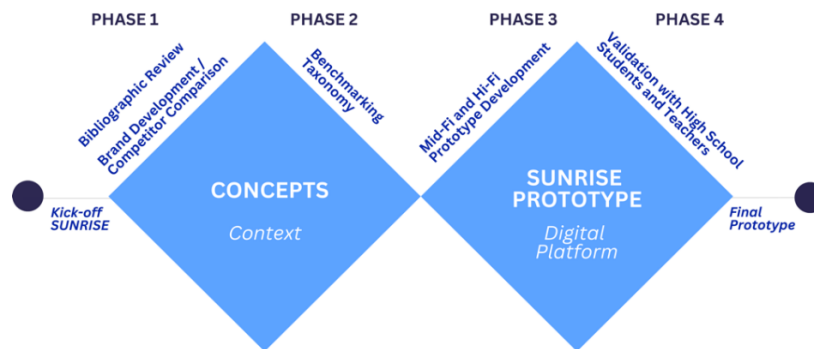


Figure 2: Symbolic representation of the development and validation cycles of the SUNRISE prototype

of child learning and development, offering a framework that both parents and designers can use:

- Active Involvement: thought and intellectual manipulation that goes beyond scrolling;
- Engagement with learning materials: Contingent interactions (every touch on the screen receives an immediate response), extrinsic motivation and feedback (responding to the child's actions with clapping or moving to the next level), and intrinsic motivation (channeling a player's unique abilities);
- Meaningful Experiences: the quality and quantity of links between the experience of the application and the broader experience of the child's life;
- Social Interaction: Social interaction allows for learning, and social contingency, the coming and going of interaction, is a critical factor in learning. Apps can take advantage of this

factor through characters' responses to children's selections, working together on an app, or video calls.

3 METHODOLOGICAL APPROACH

The development of the SUNRISE prototype was inspired by the Design-Based Research (DBR) method [18], which emphasizes collaborative research/design with the target audience to improve research outcomes. DBR stands out in educational research by combining theory and practice, allowing the development and testing of educational innovation in real-world contexts. Within this context, the Double Diamond approach - an instrument of Design Thinking [19] - was used to visualize our research process in Figure 2.

The iterative process involves four phases: discover, define, develop, and deliver [18, 19]. These phases include identifying a problem, defining the action plan, evaluating it with qualitative and quantitative data, and making final adjustments.

In the discovery phase (1), the objective was to understand the problem and the context in which it is inserted. This phase involved a bibliographic review to understand the current state of social and emotional competencies in the educational context and identify gaps the prototype could mend. At the same time, we created the visual identity and the concept of the application. In the definition phase (2), we used the insights gathered in the discovery phase to analyze best practices and solutions around SEE through benchmarking to ensure that the prototype incorporated elements that were proven to be effective. We also developed a detailed taxonomy in this domain that established the foundation organization for developing the functionalities. The development phase (3) encompassed iterative prototyping and preliminary testing. In the delivery phase (4), the prototype was then tested with 16 subjects (11 teachers and 5 students) to evaluate the usability and user experience in more detail. The tests were carried out at the José Estêvão High School in Aveiro; the goal was to re-design the prototype based on the collected qualitative data and results.

4 PROTOTYPE DEVELOPMENT

The prototype developed was designed to offer an engaging and personalized learning experience, with visually appealing graphic elements, and a responsive design that adapted to both; smaller and larger screens. In a comparative analysis made with other apps that had similar objectives, it was possible to understand the necessity of elements such as personalization, engagement, accessibility, gamification, and other techniques to keep students engaged and, consequently, focused on the user journey and the challenge.

About the functional aspects, the idea is to enrich the students' learning experience and to meet the specific needs of teachers and students in the school environment. The characteristics previously mentioned [10, 11, 17], were used to create a guideline and evaluation criteria, a working proof of concept of a digital platform capable of presenting an info-communication model for promoting SEE applications.

The taxonomy for the classification of SEE applications aims to systematize the content of a mobile application and architecture for searching. Coming from the genesis of the SEL framework (Figure 1 above), we classified the applications by the five main categories and subcategories presented in Table 1.

Some gamification features [11, 17] were added to the app, along with some badges to encourage active and more engaging participation on the platform. The gamification points serve as incentives to encourage participation and the badges are meant to offer user validation and raise user satisfaction, a sense of community building and participation [5, 6]. Additionally, since there is a current trend on chatbots and artificial intelligence, a conversational tool was added to the app to provide recommendations on apps with specific relevant activities related to SEE in the context of this project's model and taxonomy.

5 USER EXPERIENCE (UX) AND USABILITY TESTING

The SUNRISE project aims to shape and test a solution that meets SEE needs through research-based innovation and participatory

prototyping. Usability testing was a crucial component of this project, as it allowed for the collection of essential data to evaluate the effectiveness and efficiency of the prototype. Qualitative interviews took place within the biggest school cluster in Aveiro, Portugal, specifically at José Estêvão High School. The research took place in May 2024 with 16 subjects, 11 teachers from different backgrounds, and 5 senior high school students. Beginning with the ethical procedures, there was an ethical authorization for the empirical testing, namely from the head of the school cluster; from the Ministry of Education from Portugal (process N. 1439300001), and the Ethical Committee of the University of Aveiro. Informed consent was used and signed (in the case of the students, the parents or tutors had to be previously authorized) by all subjects. Users were presented individually with 4 scenarios to navigate across all the features of the application, and data was collected using a think-aloud protocol, to evaluate the usability and the user experience (Table 2) of each scenario.























6 RESULTS AND INSIGHTS

The outstanding positive feedback was related to the solution itself; all 16 participants gave qualified opinions about the possibility of navigating by using the PASEO (the profile of the students) and the taxonomy of competencies was clear to them. Some of the comments involved specific scenarios of use. For example, the Portuguese Language teacher highlighted that there is a deep need for a tool to potentiate critical thinking and approved the app and its features: "I would use it today in class". The Citizenship teacher also specified the need to create debates and make participation go beyond the classroom. In the more technical field, the STEAM-related teachers (Science, Engineering, Technology, Arts, and Mathematics), on the other hand, comprehended that there is a gap in their subject application in relation to the social and emotional competencies in terms of straightforward application and preoccupation: "We have many specific technical subjects to focus on", said one of the teachers, but if solutions similar to SUNRISE could enable them to create scenarios or deliver activities and orientation based on technology for the students they could use it. "If there was let's say a conflict in class that addressed some topic that goes beyond my knowledge, I would implement an activity of the app, but mostly the conflicts are resolved between me and the students", explained the Mathematics teacher, that has more than 30 years of experience in the classroom and highlights a barrier of usage. On the students' side, they were open and interested in using it themselves, but in the present setting of the school some didn't see how the dynamics would be if such an app was applied: "I feel engaged in the app, but I am a little skeptical that the teachers would use it", said one of the students.

Each scenario was organized as a set of tasks and the research team tagged them as "yes", "no" or "with tips" - when a task was done with success it was marked as "yes"; when it was not done with "no" or when done with some comments or suggestions "with tips". There were 9 tasks in Scenario 1, 9 tasks in Scenario 2, 6 tasks in Scenario 3, and 4 tasks in Scenario 4. With the 16 participants accounted for, there were a total of 448 tasks performed (Table 3).

With these results, it was possible to understand issues related to the navigation in the app's structure, community, favorites page,

Table 1: SEL Areas, subcategories and definition

SEL Category Subcategories	Definition	Selected Apps
Self-awareness Emotional intelligence; Constructive mind; Self-efficacy.	This refers to the student’s ability to recognize and manage their own emotions and thoughts. This skill isn’t just limited to identifying emotions; it also includes a deeper understanding of the motivations behind one’s feelings. Additionally, it involves critical self-reflection on biases, which allows students to recognize and challenge stereotypes, fostering a more inclusive and respectful school environment for all.	 Cingulo: Mental Wellbeing  Me: Reflect for Self Awareness  Dare: Anxiety Relief  SuperBetter: Mental Health  Ahead: Emotions Coach
Self-management Emotion management; Stress management; Motivation Management; Habit Management.	It deals with the ups and downs of everyday life, helping to respond more effectively to situations, avoiding impulsive reactions and making more thoughtful decisions that maintain emotional balance and well-being. It is also about the courage to take the initiative and for students to make the most of learning, for example, by actively participating in classes, asking questions, and seeking help when needed, even if it involves the student stepping out of their comfort zone.	 Mood Tracker  Ifeel  Evolve  Happify  Rabit: Habits and goals
Social awareness Active citizen; Social norms; Empathy; Compassion.	Students learn to see things from the perspective of their peers and understand what they are thinking in different situations. This helps to avoid conflicts and promotes a better school ecosystem. In addition, students are encouraged to recognize the strengths of their peers, as it not only helps to build friendships but also fosters an environment of mutual support where everyone feels valued and respected.	 Charity Miles  My Civic Services  Be My Eyes  BeKind: Acts of Kindness Ideas
Relational skills Group leadership; Positive relationships. Teamwork.	Communicating effectively, solving problems as a team, and resisting negative social pressure, that is, staying true to themselves and their values even when other peers influence them to take action, are important skills for advocates for rights, justice, and equality. Advocates must be brave enough to raise their voices against injustice, support peers, and fight discrimination.	 HBR Tip  How Leaders Lead  Class Dojo  Slack  Microsoft Teams
Responsible decision making Open-mindedness; Environment and Social Impact Awareness; Analytical Mind.	They cultivate curiosity and open-mindedness, are available to accept new ideas and seek to understand the world around them critically. They also identify solutions for personal and social problems and are creative in finding different ways of thinking. Anticipating and evaluating the consequences of their actions is critical for students to make responsible decisions, as it requires thinking carefully about how their choices may affect themselves and others in the short and long term.	 Good On You – Ethical Fashion  Newsela Student  Curiosity Stream

and profile. The user flow within the taxonomic structure was defined in the elaboration of the prototype. On the technical end, we gathered feedback on the fluid and seamless interaction, the swipes of screens, buttons, images, usage of typing fields, and the time and effort of locating a specific SEE application. The combination of the different forms of navigation in the prototype gave us feedback to improve the intuitive experience for users, with insights to meet different usability needs from age, gender, background knowledge of technology, and familiarity with the type of operating system (iOS or Android).

To complement the previous qualitative evaluation, at the end of each test, the SUS (System Usability Scale) test was applied, a widely recognized method to evaluate the usability of platforms [20]. Scoring in SUS as a valuation of each participant’s experience while testing the SUNRISE app, allows the identification of general areas for improvement and highlights 5 dimensions for the analysis. Table


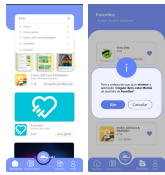
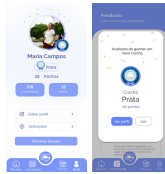
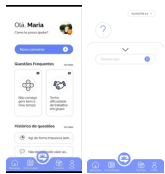
4 represents the integrated scores of the 16 participants’ opinions and contributions to each of SUS’s five dimensions.

The overall result was achieved [20] with a global score of “Best Imaginable” of 85.4 points from the 16 participants. The “Usefulness” dimension is clearly the weakest, but a detailed analysis of our data reveals this comes mainly from the contribution of teachers and not students. The same goes for the “Ease of Use” and global “Satisfaction”, but with different reasons and mainly related to the higher digital literacy of the students compared to teachers.

7 CONCLUSION

We conclude that the tests performed with the SUNRISE prototype revealed evidence of pertinence related to the prototyped infocommunication model’s characteristics and that the qualitative data that was collected also highlighted the relevance of the crucial model’s elements and guidelines that can in fact be facilitators of specific SEE application usage. By focusing on Social and Emotional

Table 2: User narratives, scenarios and app screens

Scenarios	User Narratives	Screens
1. Search for an app that addresses a specific social and emotional competency <i>Tasks performed:</i> <ul style="list-style-type: none"> - Log-in process - Filter the search using the filter bars - Find the app through filters - Use carousel 	<p>As a first scenario, we propose that the user register on the platform using the student profile with the name <i>Maria Campos</i>, ensuring they fill in all the data requested in the registration form. After the registration, the user must log in with the data they used to create the account. Next, you should navigate to the resource page and look for the "Self-management" competency in the filter bar; then, you should narrow the search further by selecting the "Habit management" subcategory. You should select the "Rabit: Habit Tracker & Planner" app among the available apps. Once inside the app page, you must use the carousel and see the images provided. Finally, you should look for the review section and read the existing reviews and ratings.</p>	
2. Use the search bar to go to an app's main page <i>Tasks performed:</i> <ul style="list-style-type: none"> - Swipe images - Add an app to your favourites list - Remove the app from the favourites list 	<p>In the second scenario, the user must navigate to the resource page (on the navigation bar). He/she should use the search bar to search for the "Evolve: Self-Care & Meditation" app. After finding the app, you should go to its page and see the images provided. Next, you should return to the resources page and use the filter bar to look for the "Relational Skills" competency. After selecting the skill, you should search for the "Class Dojo" app and open the app page, adding it to your list of favourite apps. Next, you should navigate to the bookmarks page, search for the "Cingulo" app and remove it from your bookmarks list.</p>	
3. Interact with the Community <i>Tasks performed:</i> <ul style="list-style-type: none"> - Install an app - Evaluate an application - Receive points/medal - Filter Search 	<p>Regarding the third scenario, the user should start by navigating to the community page and looking for a rating or comment about the app "Cingulum." After finding the app, the user should navigate to its page and install it. Then you should give your feedback about the app, give it four stars and write the following comment: "My emotional evolution has been very significant with this app." After submitting the evaluation, you should receive points and check your profile to check the medal and points updates. Finally, you should go back to the community page and filter the survey to see only your feedback, checking if the feedback given to the "Cingulo" app is your most recent.</p>	
4. Interact with the Artificial Intelligence chat <i>Tasks performed:</i> <ul style="list-style-type: none"> - Create a message in the chat (SunnyChat) - Use the FAQs 	<p>Finally, we propose a fourth scenario, where the user is challenged to use an artificial intelligence chat. So, the user should start by navigating to the chat page and looking for the list of frequently asked questions. Next, you should select the question: "I have difficulty working in a group", wait for the chat response and select the "Class Dojo" application from the suggested options. Next, you should return to the artificial intelligence chat page and try another form of interaction by creating a conversation and asking for help with the following sentence: "I think I have anxiety; what can I do?" It would help if you waited for the chat response and selected "Dare: Anxiety Relief" from the list of suggested applications.</p>	

Education and using a taxonomy that identifies and relates, the main key points for the development of these competencies, it allowed us to test a proof of concept prototype (with a detailed graphical interface and user narratives) with teachers and students, and with the System Usability Scale (SUS), we also confirmed that the degree of efficiency and learnability was high. This feedback facilitated important adjustments, that improved the prototype as

a more intuitive and practical technology mediation tool for these purposes.

This paper also details the iterative research and development process and part of its co-design phase supported by the feedback of high school students and teachers. Further empirical work will be pursued to strengthen the empirical evidence namely with a larger

Table 3: Total amount of scenarios, tasks and results for all 16 participants

Tasks	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Total	%
Yes	133	127	83	51	394	87,94%
No	2	9	10	0	21	4,69%
With Tips	9	8	3	13	33	7,37%
	144	144	96	64	448	100%

Table 4: Individual (max 20) and Relative (%) contributions of each SUS Dimension to total SUS score

SUS Dimensions	Usefulness	Ease of Use	Efficiency	Learnability	Satisfaction	Total (max. 100)
Score	15,9 (18,7%)	16,6	18,0 (21,0%)	18,4	16,6	85,4
(%)		(19,4%)		(21,6%)	(19,4%)	(100%)

and more diverse sample, which was a limitation of this phase of the study.

So far, it has been possible to, by using the SUS Scale, comprehend the “usefulness” dimension and the differences in perception between teachers and students. The same goes for the “Ease of Use” and global “Satisfaction”, but with different reasons and mainly related to the higher digital literacy of the sample’s students compared to teachers. This analysis will be further developed in the next phases of this research.

Also, for further investigation, there are various possibilities on the correlation of SEE and educational technology, such as the comprehension of in-class usage and comparison with the out-of-class solutions and in which way it impacts social and emotional learning.

This first trial of the SUNRISE prototype, reported in this paper, was essential to validate the research inquiring process in the school ecosystem on topics such as the use of technology to mediate and promote better social and emotional education.

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