

# Multimedia Platform Development for Parental Involvement in Learning of Children Attending Kindergarten

## *Iterative Cycles of Development*

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**Abstract:** Several studies have shown the importance of parental involvement in learning and development of kindergarten children, but also mention existing barriers, such as lack of time. The proliferation of access to the Internet and use of web tools can facilitate communication between parents and educators, reduce barriers and promote parental involvement and participation in children's learning. The study carried out is a design-based research, which aims to develop a multimedia platform that promotes communication and information sharing among educators, parents and children, facilitating parental involvement in learning. The design-based research methodology understands the development of products in iterative cycles of analysis, technological development, testing and evaluation with users, evolving towards an increasingly robust intervention. This paper presents the results of preliminary studies, the first cycle of development of the platform, composed of functional specifications, paper prototype and usability tests, ending with an introduction to the second cycle of development. This is the current development phase, consisting of a functional prototype, which is in use for evaluation by users in four kindergartens.

## 1 INTRODUCTION

Parental involvement (PI) is a very broad issue that implies the participation of parents in children's formal learning process, taking part in school-related activities. In pre-school education, four types of PI can be distinguished: participation in school, when parents do activities in the classroom; involvement at home, activities such as reading or cooking with the child, visiting museums or libraries; participation in the community, like being a member of PTA; involvement in learning, which presupposes talking to child's teacher about his/her progress, discuss it with the child, helping and ensuring that the child does homework (Reynolds and Shlafer, 2010).

There are several studies that recognize the importance of PI for the success of children's learning, pointing it as an important factor in the acquisition of skills and the results achieved (Epstein, 1995; Harris and Goodall, 2008). PI has a significant effect on child's adaptation to school and success in learning, regardless of other factors, such as social class (Desforges and Abouchaar, 2003). Involvement at home plays an important role in student

achievement and positive attitudes toward school (Melhuish *et al.*, 2008). Expectations that parents transmit to their children about what they academically aspire to them have strong influence on their success (Fan and Chen, 2001). With regard to preschool children, PI also has an impact on general development, cognitive development and school readiness (Hilado, Kallemeyn and Phillips, 2013). Positive relationships between educators and parents have an effect on children's social skills (Diamond *et al.*, 2013). Some studies have found a relationship between PI in kindergarten and the performance of children in reading and mathematics (Sonnenschein, Stapleton and Metzger, 2014). An essential element for PI is school-family communication. Effective communication is associated with academic success (Lunts, 2003). When parents communicate constructively with teachers and participate in school activities, they have a greater understanding of what their children should learn and how they can improve their formal education at home (Stevenson and Baker, 1987). Parent collaboration in school community is also related to better results and better student behaviour (Epstein, 1995). Success at a later stage of

life, particularly in employment, is established in the preschool years, which are the basis for acquiring study and work skills. This requires strong partnerships between services, family and child (Plowman *et al.*, 2011). The importance of PI is recognized in governmental guidelines for early childhood education in several countries (European Commission/EACEA/Eurydice/Eurostat, 2014). In Portugal, Curriculum Guidelines for Pre-school education request educators to involve parents, referring the need to establish bilateral and positive communication, promote good relationships and encourage the participation of families in the educational process (Silva *et al.*, 2016). However, PI has logistical, emotional or cultural constraints. The report *Learning in families* (2009) presents results of a survey to parents of pre-school and elementary school children, identifying barriers to PI and indicating lack of time as the most important. Other barriers encountered were costs associated with transportation or babysitting and difficulties in communicating with teachers (Lunts, 2003; Grant, 2009). A study conducted at 1205 kindergartens, to ascertain PI over the years, has shown that the quality of interaction between parents and educators decreases, although participation in home-based activities is consistent over time. It suggests that activities requiring physical presence in school are more difficult to maintain (Izzo *et al.*, 1999).

Today, we witness the use of technology in everyday life, for a variety of purposes, from work to entertainment, communication and personal organization. Technological tools, such as websites, social networks, blogs or e-mail, create new channels of communication and information sharing, and can improve the relationship between educators and parents. The importance of ICT for PI in learning is mentioned by several authors (Grant, 2011; Olmstead, 2013; Bouffard, 2014). Horizont Report Europe (2014), which examines trends and challenges of technology in education, point to social networks as a fast trend to accelerate the adoption of technologies in schools, as they provide dialogue between students, teachers, parents and institutions, helping parents to stay informed and giving feedback to teachers. On the other hand, children grow up well acquainted with technologies such as computers, Internet, videogames, tablets and mobile phones, using them to play, learn and communicate. Digital educational resources can be part of learning activities promoted by parents or educators, and can be shared between them, using online tools. Relevant organizations have recommendations for the introduction of ICT in education (UNESCO, 2011),

such as UNESCO's Policy Brief for use of ICT in pre-school education (Kalas, 2012), or NAEYC's position statement (2012), which advocates the integration of interactive media and technology as learning tools in pre-school education.

## 2 METHODOLOGY

Given the relevance of the theme and verifying the existence of specific needs of this target audience, researchers set up a design-based research, in which it was intended to investigate, develop and evaluate a multimedia platform, to answer the question: what are the functionalities, contents and dynamics that a multimedia platform must have to promote PI in learning of children attending kindergarten?

The term *design-based research* covers a group of research methodologies based on design and development, with some variations (van den Akker *et al.*, 2006). So, it is needed to highlight some specific characteristics of this methodology: it includes activities of analysis, design of educational prototype, evaluation and revision (Coutinho, 2006); scientific knowledge influences development, which is then tested in the field, bringing empirical data to improve the product and validate knowledge; the development process is interactive and iterative, until it reaches a satisfactory approximation of the ideal intervention; it allows to exploit the potential of ICT, in order to solve a real problem in education (van den Akker, 1999); It is based on rigorous and reflective research to build knowledge and principles that can guide future developments and studies (Reeves, 2000); The user is involved in the entire process, from preliminary studies to evaluation, in order to obtain a higher quality intervention (Nieveen and Folmer, 2013). This type of research can bring specific knowledge of a context, but be transferable and relevant to other learning environments (Richey, Klein and Nelson, 2008).

This research is carried out with a development team (designer and programmer) of the multimedia company Criamagin®, a research team from the University of Aveiro and four classrooms of three kindergartens in Aveiro, including four educators and 94 parents. In this way, the target audience (parents and educators) is involved in all phases of development, from needs assessment and definition of functional specifications to usability tests, utilization and evaluation.

Several authors present models for the operationalization of design-based research. Although the models vary in detail, they have

similarities, synthesized by Plomp (2013) in three stages: preliminary studies, development and evaluation. For this study, the model was adapted as follows: Stage I - Preliminary studies, consisting of literature review and search for state-of-art platforms, characterization of participants, survey the needs of educators and parents. Stage II - Iterative development of the platform, consisting of cycles of analysis, design, evaluation and revision of the prototype, until reaching the final product, involving the target audience in all process. Three development cycles are planned: First cycle - functional specifications, paper prototype and usability tests; Second cycle - functional prototype, pilot implementation in kindergartens and use by educators and parents, for tests and evaluation; Third cycle - final product, use in kindergartens. Stage III - Final evaluation of the impact of the product on PI in children's learning. This moment helps to verify the success of the product, i.e., to ascertain the practical results and contributions to the theory, as well as, suggestions for future studies.

Design-based research uses mixed methods to collect data, analyse and refine the intervention (The Design-Based Research Collective, 2003). Thus, a combination of different forms of data collection is used in this study, such as interviews, questionnaires, e-research, usability tests and observation. Content analysis and descriptive statistical analysis were used to analyse data. Next sections present the results of preliminary studies, the first cycle of development and the beginning of the second cycle of development.

### 3 PRELIMINARY STUDIES

Preliminary studies started with a questionnaire to parents (n = 59) and interviews to educators (n = 4) to include both perspectives and needs in a platform that should improve communication and promote PI in learning. Also, a literature review was done to find out research about PI with technological tools, to predict good practices and learn from projects already implemented. Researchers searched for existing platforms and identified their main features, to understand market trends.

Results of parent's questionnaires showed that parents value some features: news and events calendar, photo and videos gallery of children's projects and private messaging with the educator. The greater advantage of the platform is to access updated information on the work carried out in kindergarten. A general concern is the protection of personal

information, in particular, sharing photos where children are identified.

Results of interviews with educators indicate that the platform must gather official information of kindergarten and direct contacts of parents. Also, it should integrate specific areas, such as child/group history, activities developed, suggestions of activities to do with children and links to educational resources. The biggest advantages are celerity and automation of communication; promotion of parent's feedback; separation of professional contact from personal social networks. The constraints are lack of time for maintenance and parent's fear of privacy issues.

From the research of existing platform for PI, researchers summarize the most common features: private groups, individual/group messaging; image gallery; events calendar. Platforms best suited to preschool, focus on disseminating information (happened or planned), but lack the provision of strategies or suggestions that parents can explore at home, contributing more actively to their child's learning. Literature review presents some research projects which promoted PI in kindergarten through technological tools. Some results are: active participation and higher feed-back from parents; awareness about the work developed in kindergarten; improvement of relationships between parents and educators; parents' ability to extend home learning based on the information shared; reading comments with children contributed to collaborative and constructive learning (Hong and Trepanier-Street, 2004; Näsänen, Oulasvirta and Lehmuskallio, 2009; Faria and Ramos, 2011; Knauf, 2016). A detailed presentation of the preliminary studies, with a critical discussion of the results found at this stage, can be consulted in Laranjeiro, Antunes and Santos (2017).

## 4 FIRST CYCLE OF DEVELOPMENT

### 4.1 Conceptual Structure

Based on the contributions of the preliminary studies, the first cycle of development started, with the definition of functional specifications of the platform, which resulted in a paper prototype, subjected to a formative evaluation, with usability tests by the users, later on. Functional specifications are detailed descriptions of the functionalities that will be included in the platform, to meet the needs of the users and the objectives of the product (Garrett,

2011). This is an essential document for teamwork as it is a starting point for a joint understanding of the product. Until the specifications are written, there are many development possibilities, derived from brainstorming sessions, team opinions and user surveys. The project manager must clearly define what will be done, limit the scope of the project, excluding what will not be done, and set priorities and responsibilities in development. Functional specifications were written following three principles: specific, objective and positive description (say what the system should do, instead of focusing on what should not happen), avoiding misinterpretation (Garrett, 2011). With specifications defined, researchers set out the conceptual structure of the platform. The structure is presented in an architecture diagram, which is a flowchart showing the organization and interconnection of different areas (Garrett, 2011). The unit of the diagram is the node, which corresponds to a sort of information. The structure is hierarchical, composed of categories and subcategories, forming a navigation that is consistent and easy to learn by the user.

The architecture diagram (Figure 1) presents the structure of the platform. Starting from the homepage, it is divided into four main nodes. Within each node, specific contents and functionalities are presented. The diagram shows the nomenclature used in buttons and menus.

#### 4.2 Functional Specifications

The platform is divided into four areas: personal area, where functionalities and contents are available to each user, individually and privately; group area, where content is published and shared by all members

of the group, educator and parents; kindergarten area, where the educator provides institutional information to parents; support area, where users can contact the team, as well as find more information about the project.

General Specifications - the left side menu appears in all pages, giving access to three areas (personal, group, kindergarten). Each area contains submenu buttons, using the nomenclature defined in the architecture diagram. The logo of the project is placed in the header. Group name and user's photo must always be present, in an upper area of the site. In the central block, below the heading, is placed the writing area, where users can write posts. Below the writing area, posts of group members appear in chronological order. Group members can comment a post. On the right side menu, there are news of the institution, calendar of events and support area.

Writing Area - in all pages there is a writing area, where users can write posts, to share content with other group members. Users can choose where they want to publish the post: messages, *agendinha*, activities, educational resources. By default, users write messages that appear at the homepage. If they want to choose another area, they have to click on the correspondent tab. If they choose 'Educational Resources' tab, they can insert links to web pages, apps, educational games and other resources that will appear in Educational Resources Area. In each post, they must include title, link, description (required) and images (optional). If they choose the 'Activities' tab, they will insert content in the 'Suggestions' area. Here, they can choose typology: Books and stories; Songs, Handicrafts, Games and playtime, Outdoors, Other. Each contribution consists of title and description (required), link and images (optional). If

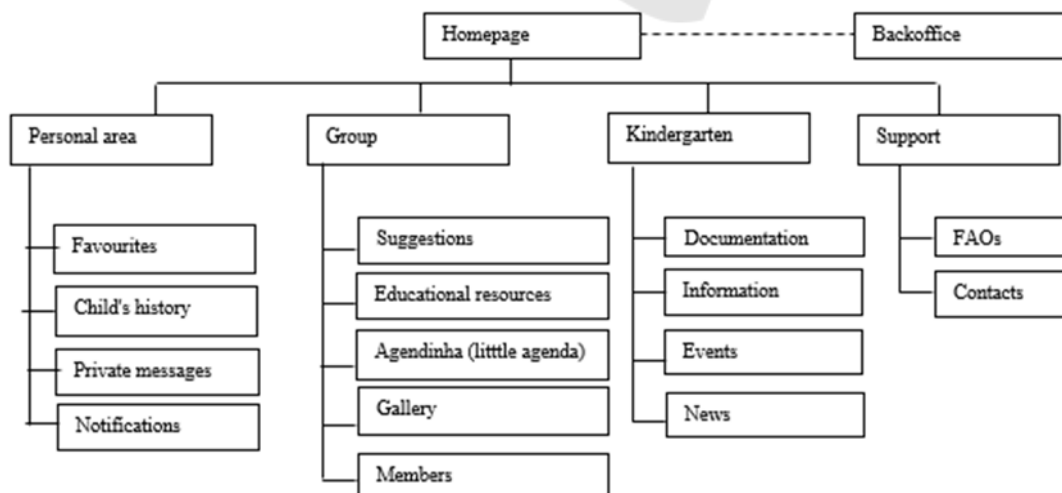


Figure 1: Architecture diagram.

they choose 'Agendinha' tab, they can insert events, using subcategories - exhibitions, cinema, theatre, music and other shows. Each contribution is composed by title and description (required), link, images, date (optional).

Homepage - at homepage, all contents published appear in chronological order, regardless of the area where they are associated. Thus, there is a chronological presentation of all posts, but at the same time, there is an organization by type: *agendinha*, suggestions, educational resources.

Gallery - area where parents and educators can share photos, videos and audio files. Possibility of creating albums within the gallery, associating name, description and date, for organization of contents. Upload of contents into an album and possibility to edit description. Chronological listing of albums and contents. Ability to comment and reply to comments about a content.

Educational Resources - area where users can see the list of links inserted by group members. The list appears divided by typologies (websites, apps, games, others). Within each typology, links appear from the most recent to the oldest. Possibility for each member to mark a link as a favourite. Ability to comment and answer to comments on each item.

Suggestions - area where users can see all suggestions of activities inserted by group members. The list appears divided by typologies: Books and stories; Songs, Handicrafts, Games and playtime, Outdoors, Other. Activities appear from the most recent to the oldest. Possibility for each member to mark an activity as a favourite. Ability to comment and answer to comments on each content.

Agendinha - area where users can see all events inserted by group members. The list appears divided by typologies: exhibitions, cinema, theatre, music and other shows. Events appear from the most recent to the oldest. Possibility for each member to mark an event as a favourite. Ability to comment and answer to comments on each item.

Members - area presenting the list of group members, with photograph and name. Photos connect to the public profile page, which displays personal information - photography, name, publications on the platform and direct connection to private messaging.

Events - kindergarten calendar, where educators can highlight activities already done or to be carried out in the future, for example, Mother's Day, Christmas. Each contribution consists of a title, a description, date (required) and images (optional). This functionality is visible to all members, but only available for editing by educators, who have permissions to insert, edit and delete events.

News - news are composed of title, text (required) and image (optional). They serve to communicate official information from the kindergarten. News are listed from the most recent to the oldest. This functionality is visible to all members, but only available for editing by educators.

Information - area where educators can upload temporary files (.pdf or .jpg) to parents, such as weekly menu and weekly planning. Possibility of associating title and description to the file. List from the most recent to the oldest. This functionality is visible to all members, but only available for editing by educators.

Documentation - area where educators can upload files (.pdf or .jpg) to parents, such as - regulations, school calendar, pedagogical plan, other. Possibility of associating title and description to the file. List from the most recent to the oldest. This functionality is visible to all members, but only available for editing by educators.

Private Messages - area where private messages can be read and written. Ability to create message and choose the recipients from the list of group members - educator, member, several members or the whole group. Ability to respond to a message.

Favourites - accessing this area, users can view all the posts they saved as favourites, listed and divided by categories - *agendinha*, educational resources, suggestions.

Notifications - users can receive notifications by e-mail. They can customize notifications by frequency - choosing to receive a daily or weekly summary; members - receiving notifications from the educator, a specific member or all members; and areas - choosing to receive notifications about events, educational resources, suggestions or messages. In the personal area, users can see and delete notifications. Unread notifications are written in bold, to be distinguished from the others.

Child's History - in this private area, parents have access to information sent by the educator about their child - images, files (e.g., pdf document with annual evaluation), or text messages. The information is stored in chronological order, constituting a portfolio or history of the child, related to his/her development and achievements in kindergarten. When accessing the child's history area, the educator has a drop-down menu to choose the parent and, after this step, share private information about the child.

Support - area with explanations about the portal, how it works, what functionalities are available, how to participate, conditions of use. It also has a contact form to development team to address suggestions, debug and help.

**Backoffice** - in addition to the profile of educator and the profile of parent, there is a third profile, the administrator's, that belongs to the development team of Criamagin, responsible for managing the platform. The administrator has access to a Backoffice area, to monitor platform data, access usage statistics and manage rooms and users. The administrator creates access to the members of kindergarten, which means creating groups, registering users with e-mails (previously provided by the kindergarten), and associating users to a created group. Users receive an email confirming registration, with instructions to enter and to start using the platform.

### 4.3 Paper Prototype and Usability Tests

With the definition of the functional specifications and the architecture diagram, a paper prototype of the platform was elaborated (Figure 2), to test the usability and the overall design with the user, at an initial phase of development. Usability is formally defined in standard ISO 9241, as the ability of a product to be used with effectiveness, efficiency and satisfaction by specific users to achieve their objectives in a context (ISO, 1998). It is a quality attribute that measures whether the interface is easy to learn and use, whether the features are easy to remember, the type and number of user errors, and speed of task execution (Barns, 2004).

A paper prototype is a recommended technique for making usability studies, in the beginning of the development, because its implementation is fast and

economic. It allows the team to gather data about usability, at a very early stage of a project, and to improve the user experience. At this stage, it is still possible to change the approach to the problem, change the set of resources specified for development, and even change the interface architecture. These changes are no longer feasible in terms of costs and deadlines when the product is tested at a later stage of development (Nielsen, 2003).

At this global design definition phase, the topics to be evaluated with the user are Relevance (content validity), Consistency (construct validity) and Practicality (to check if users expect to use the product in the context for which it was created) (Nieveen and Folmer, 2013). The study of usability in the global design phase doesn't focus on graphic or layout, but test general understanding, navigation, concepts, buttons and menus nomenclature, contents associated to each area, choices to display information on each page, identification of missing features and resources (Nielsen, 2003). For these tests, there is no need to have all functionalities implemented, but a horizontal representation, a first level that presents the features and allows the users to perform/simulate tasks (Rubin and Chisnell, 2008). A balanced usability test can be performed with five potential users. Five users discover 80% of the problems, including in this percentage the biggest problems. The fifth user typically observes the same results and does not add much new information. In case there are different categories of users, for example, teachers and students, it is advisable to test with three potential users of each group (Nielsen and Sova, 2003).

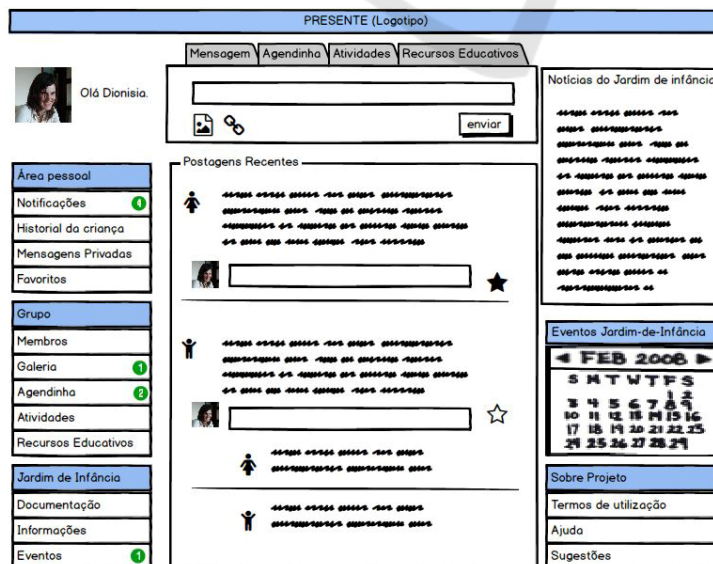


Figure 2: Paper Prototype.

Researchers have created a paper prototype, simulating the main areas of the platform to be tested by users. It was necessary to create a fictional room, with members of both profiles (educators and parents), to better understand the interactivity, navigability, dynamics and contents generated in the platform.

#### 4.3.1 Usability Tests Planning

The test plan is based on the recommendations of Rubin and Chisnell (2008), and describes what will be done during the test, discriminating objectives, participants and procedures. Usability test objectives are: to probe the relevance, consistency and practicality expected of the use of the product, by two groups of users (parents and educators); to understand whether both groups of users can use the product equally well; to identify obstacles to use. Tests followed a common set of procedures: presentation of the study to the participant, noting that it's not the user that is being tested, but the product, and that his participation is important; filling out a small questionnaire about knowledge and experience with Internet communication tools; usability test, consisting of a "walk through" (Wharton *et al.*, 1994) of the paper screens and the accomplishment of tasks proposed by the moderator, simulating click action on the screen with the finger touch on the paper. Researchers encourage the use of the "Think aloud" protocol (Someren, Barnard and Sandberg, 1994) by the participant, to facilitate researcher's annotations. Tests ended with an interview related to attitudes regarding the use of the platform, to know the opinion and perceive the interest and expectation of users.

About the participants, eight individual tests were carried out with four educators and four parents, representing both groups of users of the platform. The instruments were pre-tested with a mother from another kindergarten.

With these tests, researchers intended to collect two types of data: performance data - errors and completed tasks; understanding of structure and navigation; preference data - ease of use and learning, nomenclature, perceived utility, expectations. Usability tests results of paper prototype are presented in the next section, suggesting changes and improvements to implement in the functional prototype.

#### 4.3.2 Usability Tests Results

The usability assessment was done with four educators (E1 to E4) and four parents (P1 to P4).

According to the data collected in the questionnaire, all of them use Internet services every day, but have different levels of participation in social networks, from observation (e.g., P2 and P3 only read posts) to full social interaction (e.g., P4 and E4 read/write/answer posts, share images/videos; belong to Groups; use instant messaging).

#### Initial Considerations

After ended the questionnaire, participants described the main screen, on paper, pointing out the different areas, giving suggestions and expressing doubts. From this first part of the test, researchers were able to verify the general understanding of the platform and hear the first opinions of the eight participants. Everyone understood the general layout, identifying the menu area, the writing area, and the body of the site, where users' posts appear. They understood the division of the menu into three sub-levels (personal, group and kindergarten). Some considerations were retained for possible implementation in the second cycle of development.

E1 thinks that the tabs above the writing area are confusing, as well as the use of the word 'Messages'. She was unsure if it was intended to private messages or messages to the homepage. She suggested to put the writing area of each section only in that section, that is, if the user is at the homepage, the posts he writes appear only there. The tabs were not understood by P2, who described it as buttons to change pages.

E3 asked if 'Child's History' is only accessible to the child's parents, showing concern about privacy. She also suggested that parents could share with the educator what their children do at home, in this private area.

P3 noticed that the posts did not have date and time details.

Three parents asked about the possibility of blocking members.

#### Results of Tests with Tasks List

After the initial description, the prototype was evaluated based on a task list. According to the question asked, participants pointed out with the finger and explained the procedure to accomplish the task. As they finished the task, they moved forward, changing the page of the prototype.

Table 1 presents the tasks questions associated with the functionality and the participants who were able to successfully complete the task (x). Those who did not understand the task or performed it with error have the space blank. Visually, the table gives an

overview of the functionalities best understood and the ones that caused major errors. Analysing the table, tasks that caused major problems are associated with the areas: edit profile, educational resources, activities, information and favourites. Participants made comments during the tasks, which were taken into account for the second cycle of development.

In task two, E1 said that "Edit profile" should be written next to the photo. Three parents said there should be a button in the personal area to edit the profile.

In task four, P4 pointed out that a submit button is missing. He asked if he should just press the ENTER key.

In task six, E4 found an error. The structure did not have a back button. Without it, he gets stuck in private messages. He also suggested that it should be possible to send private messages to multiple members at the same time.

In task eight, E4 didn't identify the news because he was looking for a button named news.

Task 11 was not achieved by any participant due to the nomenclature educational resources. Four

participants suggested changing the name to links, useful links, or interesting links.

In task 12, the same happened. None of the participants understood what were suggestions of activities, confusing the purpose of this area (sharing stories, songs, arts and crafts...), with educational resources (links to websites, apps, videos) and activities done in the kindergarten classroom. E1 said she did not agree on the division by typology, because the activities they do may include various types - a book becomes a theatre, a song, music, etc. E3 has proposed taking out the word Suggestions because what makes sense is to share activities that they are doing at school or at home. P3 has identified another error, a link to return to homepage is missing.

Task 13 was well understood, although P4 confused *agendinha* with events. Three participants considered that *agendinha* and events could be together. Two educators did not like the term *agendinha* (little agenda), it should be agenda. E1 thinks that, like in resources and activities, it shouldn't be divided into categories, because it is one more step. She thinks it's better that the user simply

Table 1: Tasks and performance of the users.

Task	Functionality	E1	E2	E3	E4	P1	P2	P3	P4
1	Who is the user who owns this page?	Profile	x		x		x	x	x
2	Imagine this is your personal page. How can you change your photo and profile information?	Edit profile	x		x			x	x
3	Do you think there's new information you haven't seen yet? Where can you check?	Notifications	x	x	x	x	x	x	x
4	Imagine you want to comment on the second post. What should you do?	Comment	x	x	x	x	x	x	x
5	Now you want to add a photo and insert a comment to share with the group.	Write post	x	x	x	x	x	x	x
6	Send a private message to the educator.	Send messages	x	x	x	x	x	x	x
7	Do you have unread messages? From who?	Received msg.	x	x	x	x	x	x	x
8	Access the news from kindergarten.	News	x	x	x		x	x	x
9	Add the news to favourites.	Add favourites	x	x	x	x	x	x	x
10	Access photos about outdoor activities.	Gallery	x	x	x	x		x	x
11	Share with other parents a website with very funny activities.	Educational resources							
12	Check for interesting book suggestions to read.	Suggestions							x
13	Share, with the other parents, information about a play that will happen at the Congress Centre.	<i>Agendinha</i>	x	x	x	x	x	x	
14	Check the date of Kindergarten's party.	Events	x	x	x	x	x	x	x
15	Check the menu and weekly activity plan of the kindergarten classroom.	Information	x						x
16	Open the rules of kindergarten to check the periods in which it closes.	Documentation	x	x	x	x	x	x	x
17	See the profile of the mother Anna.	Members	x	x	x	x	x	x	x
18	You are at home/classroom and want to do an educational activity with your child/class. Show some contents you've saved.	See favourites	x	x	x				x
19	See the information the educator shared with you about your child's development.	Child's history	x	x	x	x	x	x	x



enters the event and describes what it is.

Task 15 caused errors and several considerations. Three participants feel that there is no distinction between documentation and information. Three participants see no advantage in having this area, as information can be published in activities or news. E2 thinks information should disappear and be replaced by two new buttons, one for menus and another for planning. Educators and parents agree that menus are important to get parents to consult the platform.

Task 18 also caused some errors. Participants were not considering favourites as a tool to keep information to show children, but for their own use. However, once they understood it, the possibility was very well accepted.

### Final Interview

Finally, an interview was made to understand the attitude towards the platform, perceive their interest and expectation of use.

Everyone considered the platform intuitive, easy to learn and use. Three participants mentioned that the kind of interaction is familiar.

All educators said they will use the tool to communicate with parents privately and share information with everyone. All parents said they will use the platform to communicate with the educator, two consider sharing information with other parents.

All educators think they will use the platform to do learning activities with children in the classroom. With regard to parents, two of them said they will use it to do activities with their child. P2 said it depends on available content and P3 said she does not know, due to lack of time.

Regarding the frequency of consultation and participation in the platform, responses varied, with educators tending to consider daily use and parents considering weekly use. Two participants mentioned that if the application is easily accessed by mobile phone they will use much more than if the access is on a computer.

## 4.4 Evaluation Moment – End of First Cycle of Development

The evaluation with users of the paper prototype served to ascertain the relevance of the content, platform consistency and expected practicality, helping to predict the use of the platform by educators and parents. It allowed the research team to check the overall understanding of the platform by both profiles and to identify some improvements and changes to the initial prototype. It also allowed to identify

attitudes towards the use of the platform. Thus, regarding the performance of the users, researchers can conclude that most of the functionalities were well identified.

There were mistakes and doubts that happened, recurrently, in same tasks: Change Profile, Educational Resources, Suggestions, Information and Favourites. Researchers also identified navigation failures, such as lack of back button. From this evaluation, it was decided to proceed with some changes: Add new buttons: edit profile, return to homepage, send comments, back in private messages; Rename Educational resources to Educational links; Remove Information area and create Menu area; Writing area will have no tabs; Join Events and Agenda, instead of being a calendar, it will be a chronology of posts; Activities will be an area to share comments and photos about classroom projects; Educational Links, Activities and Agenda will not have subdivisions. It is one more step and it is not valued. It will be a chronology of posts, to keep up with the work developed in kindergarten.

Regarding the user's attitude toward the platform, answers to the interview indicate that users value the platform and intend to use it. Educators want to have an active role, with a daily use for sharing photographs and comments on the activities they do with the children, while parents point to a weekly use, more directed towards communicating with the educator than for sharing with other parents or carrying out educational activities with children. Access through mobile devices seems to be a condition for more frequent use.

To conclude, tests on the paper prototype have identified small changes that could also be implemented at a later stage of development, such as back buttons or nomenclature. However, this evaluation led to rethinking areas of the platform that would be difficult to change later, due to complexity, development time and costs. As these changes were identified at this stage, they will optimize the programming work of the functional prototype and allow the inclusion of functionalities according to user's suggestions, such as: join agenda and events, writing area without tabs; Links and activities available chronologically, without subdivisions.

## 5 SECOND CYCLE OF DEVELOPMENT

It was defined the launch of the functional prototype (Figure 3) on 15<sup>th</sup> of September, because researchers

wanted to present it to parents at the beginning of the school year in kindergartens. Having a small team and short development time, it was necessary to define priorities and choose the features to develop for the launch.

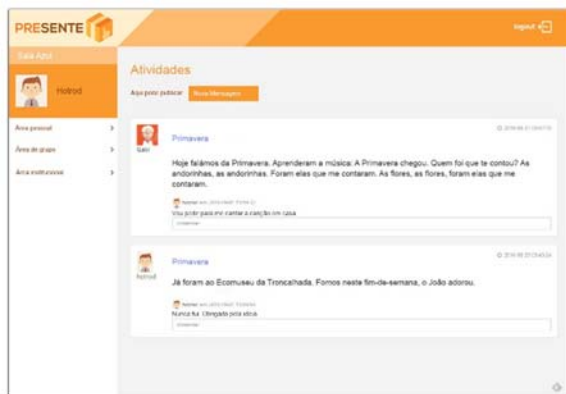


Figure 3: Functional prototype.

Thus, it was decided to have a version that included a Backoffice, for managing rooms and users (listing, creation and elimination of rooms and association of users) in September. In Frontoffice, it was privileged the development of the following functionalities: Personal Area: Child's history, to share private information between parents and educators; Favourites, to save posts of greater interest; Notifications, to inform when there is new information and encourage the consultation of information; Group Area: sharing activities, events and educational links, by all members of the group. Kindergarten: news from kindergarten.

Since the platform contains personal data of children, each user only accesses the information of the classroom attended by his child, having a login and password for identification. Other functionalities and system security measures will be implemented at a later stage of development.

## 6 FINAL CONSIDERATIONS

Design-based research methodology refers that the inclusion of the target audience in the process of developing an educational technology product is an essential condition to meet their needs, and have a product closer to the ideal intervention. Researchers could corroborate it at different stages of their investigation. In preliminary studies, numerous possibilities of development were presented to parents and educators. Results of this stage helped define the functional specifications and the

architecture diagram. In the first cycle of development, usability tests allowed to redirect, simplify, and even eliminate previously specified functionalities.

Now, the project is in the second cycle of development. Functional prototype is already in use and test in four kindergarten classrooms, evolving to a final product, based on the formative evaluation of users. At the end of this stage, researchers will be able to determine which functionalities a multimedia platform should have to promote PI in learning of children who attend kindergarten.

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