

Bucco-kid[®], an Innovative Tool for Learning Oral Hygiene at School

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Abstract: Numerous studies have shown that socio-economic background, parents' professional status and geographical location are determining factors in access to oral health care and awareness of its importance. In view of the significant social and territorial disparities observed in children's oral health (Anastasio, Laventhal & Amadon, 2022), schools are an ideal place to take action and reduce these inequalities (Ministry of Education, 2021). Indeed, schools enable us to reach all pupils, whatever their socio-economic background. On that perspective, Bucco-kid[®] project was conceived, drawing on the advantages offered by e-digital technologies. Bucco-Kid[®] platform provides elementary school teachers with a set of scripted teaching resources, constantly updated by oral health professionals (dentists). These resources, in line with school curricula, cover the key points of oral hygiene, such as discovering the mouth, nutrition, brushing, the role of the dentist and trauma management. They enable teachers to carry out a complete 5-step awareness-raising program with their pupils. The aim of this study is to analyze the usability of the platform from the point of view of teachers' user experience (UX), and actual use of the tool in classroom situations. Data are very positive about its implementation and democratization on the studied context.

Keywords : Children's oral health, Digital learning, Usability tests, User experience

1. Context and Issues

Since the late 1980s, children's oral health in France has overall improved, with a noticeable decrease in the prevalence of tooth decay. Several combined actions have contributed to these advances: dental check-ups starting at the age of 3-years-old and the presence of fluoride ions in toothpaste. While the presence of cavities has significantly decreased in France, there are still significant disparities and inequalities in the field of oral health from a very young age (Anastasio, Leventhal, & Amadon, 2022; DREES, 2022).

These inequalities, especially in access to care, lead to delayed cavity detection. In kindergarten, 4% of children from executive backgrounds have at least one untreated cavity, compared to 23% of children from working-class families. Additionally, it is observed that 20 to 30% of children account for 80% of all cavities. Despite relatively good oral health among residents in European countries compared to other continents, oral health inequalities persist across all European nations (Forster et al., 2018). Socio-economic background, parents' professional status, and territorial location (urban vs. rural areas) are determining factors in both access to care and understanding the importance of oral health. Schools appear to be important actors in reducing social health inequalities, particularly in terms of oral health prevention, as all children can benefit.

School dental health education positively affects children's oral health, knowledge, and behavior (Priya, 2019), but repetition and reinforcement are crucial for its effectiveness (Haleem, 2016). Most school-based oral health interventions are single 1.5-hour sessions led by professionals, students, or parent dentists, which overwhelm students with too much information in a short time, leaving teachers unable to revisit the concepts.

The materials and resources available for teaching children about dental health have several limitations: (i) Children's literature tends to be moralistic and provides static content (e.g., "you shouldn't eat too many candies"). (ii) Existing applications often use the same scenario, where the child plays a dentist focusing on aesthetic treatments. (iii) Board and card games lack real educational objectives.

It is in this context that the Bucco-kid platform was designed to enable teachers to conduct oral health prevention sessions themselves by providing a variety of scientifically validated resources.

2. Theoretical Framework

From an instructional design perspective, Bucco-kid[®] is based on a participatory and iterative collaborative approach involving children (ages 6 to 8), their parents, volunteer teachers, and dentists and/or future dentists (Dinet, 2015, 2020; Dinet, Bauchet & Hoareau, 2019). These participants contributed throughout the

development process to both substantive aspects (content, activities, etc.) and formal aspects (graphics, modes of interaction, etc.). The platform (free) consists of a playful environment with simple activities and content tailored for children and families (e.g., using age-appropriate vocabulary) (cf. fig 1 and 2).

The Bucco-kid® scenario is grounded in the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991), which suggests that behavior is driven by the intention to engage in it. Stronger intentions lead to greater effort and higher likelihood of performing the behavior (Nigbur, Lyons & Uzzell, 2010). TPB includes three key components: (1) Attitude toward the behavior (positive or negative). (2) Subjective norm (perceived social pressure). (3) Perceived behavioral control (perceived ease or difficulty of the behavior).

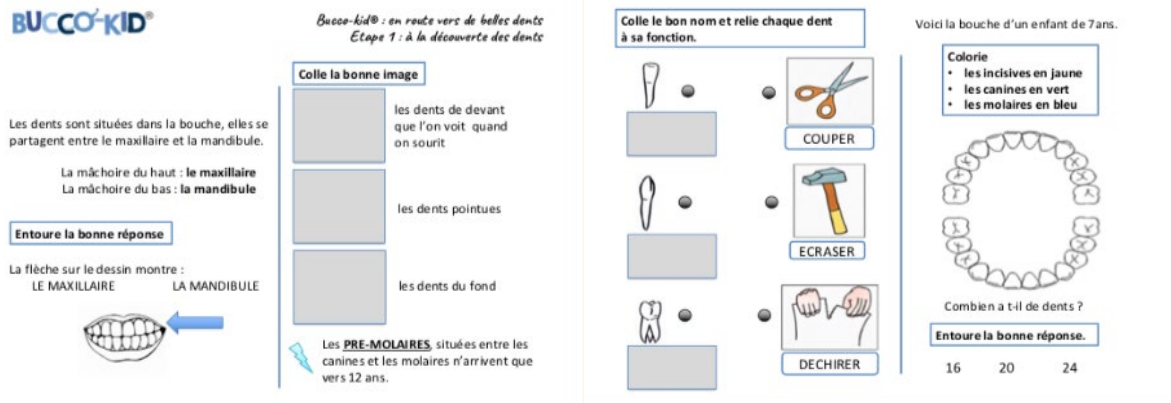


Figure 1: Examples of Bucco-kid® exercices

The Bucco-kid® digital platform for teachers was designed using a user-centered design approach, which involves considering user characteristics and needs and actively involving end users (Norman & Draper, 1986; Karat & Bennett, 1991). The Technology Acceptance Model (TAM) by Davis (1989) and other theories such as SAMR (Puentedura, 2009) and ASPID (Karsenti, 2013) were also utilized. The platform follows these technological principles: (1) Clarity and simplicity: Information should be concise and well-structured (Lallemand, 2018); (2) Ease of navigation: Users should easily find information through a thoughtful structure and visible menus (Lallemand, 2018; Brangier & Gérard, 2021); (3) Adaptability to different devices: The site must be responsive across computers, tablets, and smartphones (FasterCapital, n.d.); (4) Accessibility: Features like alternative descriptions for images and keyboard navigation should be included (Brangier & Gérard, 2021); (5) Visual coherence: Consistent use of colors, fonts, and graphics contributes to a professional user experience (FasterCapital, n.d.).

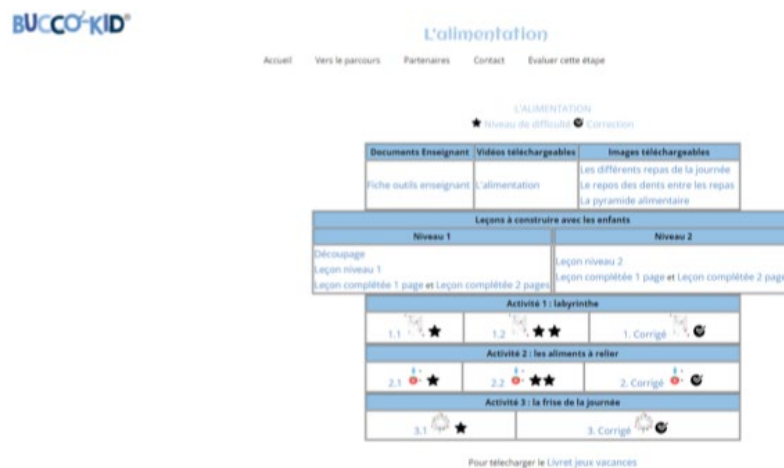


Figure 2: Example of Bucco-kid® screenshots

This educational platform offers a five-step oral health prevention course (corresponding to the five terms of a school year in France) covering the fundamental points of oral health: discovering the mouth and cavities, diet and the role of sugar, brushing, the role of the dentist, and the prevention and management of dental trauma in case of a fall (cf. fig. 3).



Figure 3: Example of 5-steps-path in Bucco-kid®

3. Problematic and Hypothesis

Bucco-kid® consists of an oral health prevention course designed for children aged between 6 and 8-years-old, intended to be conducted by a teacher in a classroom setting. This solution appears to be more “cost-effective” compared to “conventional” oral health prevention actions, which typically involve a one-hour intervention in the classroom led by dental students or practitioners. While enjoyable for children, this “conventional” practice has several limitations: (1) the amount of information to be transmitted to children is difficult to assimilate in a single one-hour session; (2) territorial inequalities pose a significant issue due to the lack of human resources; (3) the health crisis has shown the value of a “turn-key” preventive course that can adapt to the specific needs of each class; (4) as mentioned earlier, existing resources and materials are often irrelevant and poorly adapted.

From these observations, we pose the following question: how do teachers utilize these digital tools to raise awareness of oral hygiene among children aged between 6 and 8-years-old?

Based on this question, we propose the following hypotheses:

Hypothesis 1: The characteristics of the Bucco-Kid® platform, in terms of perceived usability and perceived use experience, influence its acceptance and actual use by teachers. It is the aim to understand if the platform actually improved oral-health teaching and learning.

Hypothesis 2: The Bucco-Kid® platform, designed to enhance a quickly and effectively access to educational contents and tools for conducting their lessons, is therefore effectively used by teachers. Here the aim is to understand if the learning content are adequate to the learning purposes.

Hypothesis 3: The use of the Bucco-Kid® digital platform in an ecological context, incorporating interactive and playful features tailored to young audiences, makes learning about oral hygiene more engaging for pupils aged 6 to 8. The aim is here to observe the actual benefit of the use of the platform in a real context.

4. Methods and Data Collection

The aim of this study is to analyze the usability of the platform from the point of view of teachers' user experience (UX), and actual use of the tool in classroom situations in order to improve the quality of the learning aspects of the platform. On that perspective we designed a qualitative protocol allowing us to observe the use of this platform on two different levels: at first a usability test, to identify the possible improvement of the platform; second, we will observe the real use of the platform in a actual class by teacher and their pupils.

1. Usability Test:

- Sample: 10 teachers have been selected from different schools, half of them including Bucco-kid in their curriculum and the other half not using them. The number of subjects has been defined after the works of Nielsen (1993) explaining that to evaluate 85% of the usability issues of a digital platform, five participants from the same target user category would be needed.

- Observation Methods: First, an UX-type exploration (Brangier & Gérard, 2021) of the platform and execution of instructions given by the researcher. The navigation was video-recorded using a videoconferencing tool. The data was anonymized and a consent form was signed. Then, semi-structured interviews were conducted to delve into the teachers' perceptions and discuss their feedback.
2. Usage Test:
- Sample: 4 teachers, 1 class of 6-7-year-old pupils, and 3 classes of 7-8-year-old students, totaling 86 pupils.
 - Observation Methods: In-person observations were conducted in real classroom settings. During these in situ observations, an observation grid was used to take notes on several aspects: the modalities of platform use by the teacher, the teacher's interactions with students concerning the digital content, students' reactions, behaviors, and verbalizations regarding the platform, any technical or pedagogical difficulties encountered, and other relevant contextual elements. Additionally, some sessions were video-recorded to capture the full course of activities, verbal exchanges, interface manipulations, and more.

Duration of the study: The four-month study consisted of three phases: (1) Protocol Development and Teacher Recruitment: Initial phase. (2) Remote Usability Testing: Conducted via 45-minute individual sessions on Webex, recorded on video, following Hammontree, Weiler & Nayak's (1994) framework. This approach allows detailed usability evaluations without geographical constraints. (3) In Situ Usage Study: Two-hour classroom sessions.

5. Results

The usability tests identified several ergonomic challenges to address: the incompatibility of the interface with vertical menu scrolling on the tablets used in class (issue with responsiveness); the insufficient visibility of certain key resources ("vacation booklet" and brochure on dental trauma). The ecological user test revealed issues related to printing some materials, which necessarily have to be in black and white in schools. This significantly degrades their readability, and thus their attractiveness and clarity for students. Observations in real teaching situations showed that the most utilized resources are the lessons and explanatory videos. However, the proposed practical activities are less frequently implemented. Despite this, an encouraging element was noted: students show great enthusiasm when exposed to the various contents (notably the videos), demonstrating the platform's motivational potential. While most teachers rely on the provided resources, some also choose to integrate their own supplementary materials, illustrating the pedagogical freedom offered by the digital tool. Finally, it appears that the platform is still primarily used as a lesson design tool rather than as an in-class animation support. Its potential for interactivity and dynamic implementation of learning thus remains to be further developed.

The main results of this study, in connection with our initial hypotheses and the theoretical framework established at the beginning of our research, offer interesting perspectives on the use and effectiveness of the Bucco-Kid® platform in teaching oral health.

Concerning the first hypothesis, The identified ergonomic challenges influence the acceptance and usage of the platform. However, its use in lesson planning suggests a certain level of acceptance. Further evaluation is needed to assess improvements in teaching effectiveness.

Concerning the second hypothesis: Teachers do effectively use the platform to access educational content, primarily lessons and videos. However, the underutilization of practical activities suggests that not all aspects of the platform are fully utilized. The alignment of content with learning objectives requires further evaluation.

Supported by extensive observations, students' enthusiasm towards the content, especially videos, demonstrates the motivational potential of the platform. However, its use in the classroom as an interactive teaching aid needs further development to fully exploit its potential in a real-world context.

6. Conclusions et Perspectives

This study shows that the Bucco-Kid® digital platform, despite some areas for improvement identified, receives an overall very positive and enthusiastic response from both teachers and students. Teachers expressed satisfaction with the content and functionalities provided, which greatly facilitate the preparation of their lessons, even on topics where they sometimes lack specific expertise. Some even observed good assimilation of the concepts by the students thanks to the digital tool. This very favorable feedback from the end users suggests

a sustainable adoption of the platform by the teaching staff. The next development steps will involve optimizing the platform based on the feedback and improvement points highlighted during our study. We will aim to enhance interactivity and teacher engagement so that the platform can be fully utilized in real-world settings while leveraging the benefits of digital environments. The goal is to create a solution that is both tailored to the needs of teachers in their classrooms and offers the richness and performance of an innovative online tool. Given that this is a "work in progress" contribution, we will deepen our study of the platform by analyzing the process of "didactisation" of the topics conducted by the teachers.

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