

A Catalog of Web App for Smart Teaching

Marco Corbato, Antonina Dattolo

SASWEB Research Lab, Department of Mathematics, Computer Science, and Physics, University of Udine, Italy
marco.corbato@uniud.it - antonina.dattolo@uniud.it

ABSTRACT

AppInventory is a Web platform, which proposes a holistic view on a digital catalog of 271 applications, an innovative visual layout, and semantic browsing structures; the applications have been organized in an original taxonomy and can support users in creating and sharing digital artifacts, aggregating, remixing and collecting heterogeneous materials and communicating within working groups.

KEYWORDS

Web 2.0 applications repository, App 2.0 taxonomy, Multimedia design and development for smart e-learning, Innovative smart teaching and learning technologies, Multimedia for user engagement and motivation in education.

1. INTRODUCTION

The Web offers hundreds of applications, which a challenging opportunity for teachers who would like to experiment and adopt student-centred methodologies and use them into daily teaching and learning activities; opportunely used, these applications can improve the collaborative, cognitive and creative work of the students, and enhance and redefine traditional educational practices. Nevertheless, although these applications are generally easy to find and use, it is often difficult, for a teacher, to identify the right one for a specific task, and to have a general awareness on their availability their potential in an educational setting.

AppInventory [5, 6] proposes a new platform and an innovative browsing tool for overcoming these limitations. The Web platform contains a multimedia catalog of 271 applications, organized by applying an original taxonomy, offering users the opportunity to explore according to personal paths, assigning ratings and leaving comments to the applications. The AppInventory platform is consistent with the objectives of the European Digital Competences Framework for Citizens 2.0 (DigiComp) [13]: in particular, it can contribute to the development of ten of the twenty-one competence dimensions stated in the DigiComps conceptual reference model.

2. RELATED WORK

Several repositories index applications, proposing classification and evaluation [2, 3, 11] schemes.

A rich discovery engine of websites, mobile apps, desktop programs, and electronic products for teaching and learning is EdShelf [9]: a user can filter the tools by price, platform, subject, age, category and keywords. Unfortunately, subject and category are two long flat lists of keywords. Essediquadro [10] is a service of documentation and orientation on the teaching software and on other resources for the learning process. The tools can be searched by subject of study (Mathematics, Italian, etc.) and by specific subject matter, but the category of the tools is not considered. Similar search fields are proposed by Apps4edu [1]. It is possible to list all the apps in it, but the result is a flat, unusable, paged-list of tools. CSE (Common sense education) [4] invites one to find the 'perfect tool'; it introduces the interesting, abstract concept of purpose, but it is used more as teaching context of use more than real purpose.

3. OPEN ISSUES AND OUR AIMS

Related work highlighted some open challenges and weaknesses:

- the navigation and searching of tools do not offer a general overview, but long lists of applications, often difficult to read;
- there is a complete lack of graphic views, which could offer users a visual, holistic idea of the existing tools;
- the concept of category as a tool is often thought of as a subject of study, or context of use and not as purpose for teachers. The existing taxonomies are not purpose-based; the semantic relations among the tools are not highlighted, and the degree of belonging of a tool to a cluster in the taxonomies is not clear;
- The user interaction is limited.

Our contribution focuses on overcoming these limitations.

4. THE WEB PLATFORM

AppInventory is a free Web application (<http://appinventory.uniud.it>), which uses SVG/HTML5/CSS3 Web standards and powered by D3 data driven visualization library, PHP, MySQL server side technologies and AJAX techniques.

Data model is based on zz-structures [7, 8, 12] enriched with specialized zz-views in order to offer original exploration solutions in addition to traditional searches and data filtering. It contains 271 cards of Web 2.0 applications organized into 3 main macro-categories, as shown in Figure 1.



Figure 1. An holistic view of AppInventory.

Collaboration & Communication tools contains applications, organized in 7 sub-categories, to manage groups, to collaborate on the same documents online, to support users in planning projects and activities, to interact in real-time on a virtual board or to collect data by surveys and quizzes; *Authoring tools* contains applications (in 13 sub-categories) to support users in building up digital artifacts of various typologies; *Aggregators* contains applications (in 4 sub-categories), which support users in collecting homogeneous or heterogeneous materials.

The size of each circle is proportional to its populosity. Due to the apps' hybrid characterization, the attribution to the categories is multiple and weighted.

Semantic zoom. Zooming in additional items (see Figures 2 and 3) become visible at an appropriate zoom level in order to enhance the understanding and minimize the cognitive load. Continue zoom mechanism minimizes users disorientation.



Figure 2. Views for different zooming levels.

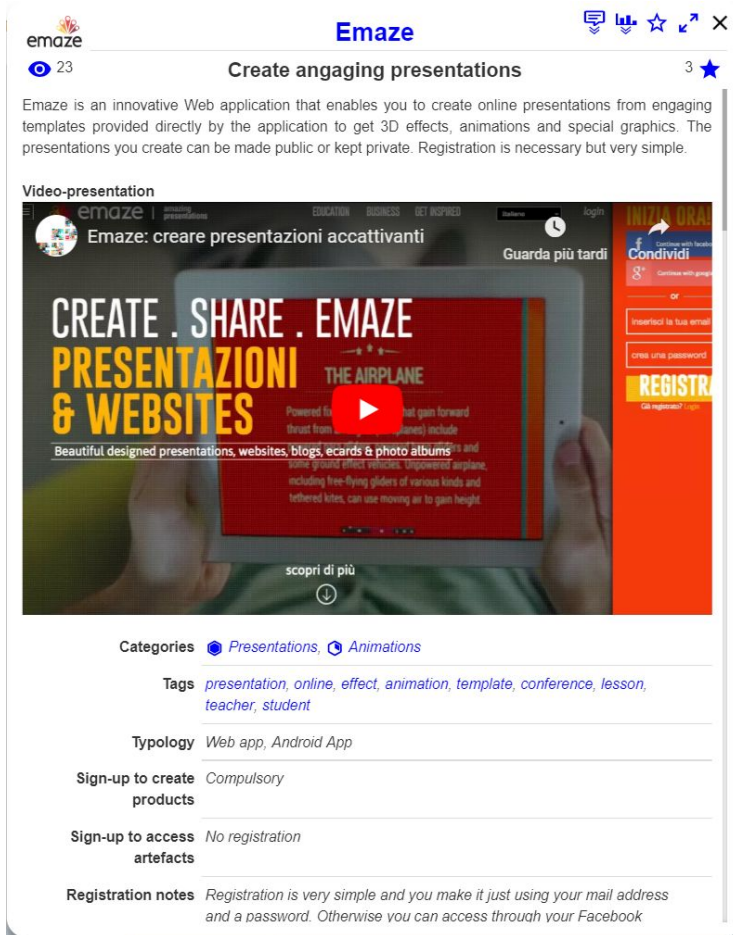


Figure 3. The card of the Emaze app.

Navigation mechanisms. Based on zz-structure's ranks, following Figure 4:

- Left/right arrows move to previous/next app in the current navigation set of applications (default: apps in the same category). Navigation window shows the list of the apps in the current navigation set.
- Select a new navigation set by clicking on the compass on top-right.
- Each criterion is marked with a color.
- Criteria can be combined with AND/OR operators; compound criteria are marked in yellow.

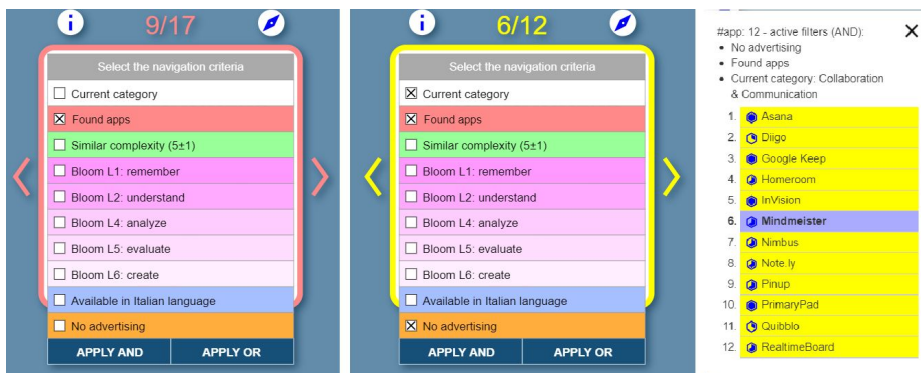


Figure 4. Navigation mechanisms.

App ratings. AppInventory collects user ratings about the apps on four aspects plus a general one, as shown in Figure 5.

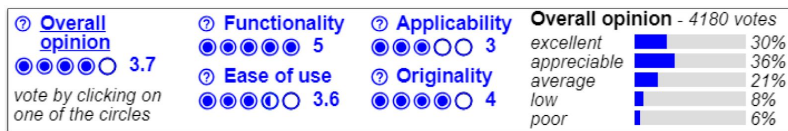


Figure 5. Ratings.

User contribution. AppInventory collects users' contributions for the single app: comments; reports on description card; descriptions of original use cases and for the overall catalog: suggestions of new apps.

4. CONCLUSIONS AND FUTURE WORK

More details on AppInventory is available on the dedicated Website. Future work will involve the constant updating of the information published in the catalog, the development of new views and new features, the optimization of the Web interface for mobile devices, the experimentation of a recommender system based on zz-structures and a more complete user evaluation which allows to consider different aspects of the platform and the effectiveness of the adopted solutions

5. ACKNOWLEDGMENTS

We would like to thank all students that participated to this project and contributed in different ways to the birth of the catalog. We mentioned all their names on a dedicated page <http://appinventory.uniud.it/en/about-us/> of the AppInventory platform.

6. BIBLIOGRAFIA

- [1] Apps4edu. <http://www.uen.org/apps4edu>. Last visited 28 December 2018.
- [2] T. Cherner, J. Dix, and C. Lee, "Cleaning up that mess: A framework for classifying educational apps," *Contemporary Issues in Technology and Teacher Education*, vol. 14, no. 2, pp. 158–193, 2014.
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Abstract

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Visual Driven Interface

The choice of visual driven user interface is crucial to pursue usability and rich data navigation. Circle partition, implemented over scalable vector graphic (SVG) W3C standard, offers a zoomable holistic view of the purpose-based taxonomy.

Semantic Zoom

- Initial comprehensive view of the entire repository, without exposing details of the apps.
- Continue zoom mechanism to minimize users disorientation.
- Additional items become visible at an appropriate zoom level in order to enhance the understanding and minimize the cognitive load.

Navigation mechanisms

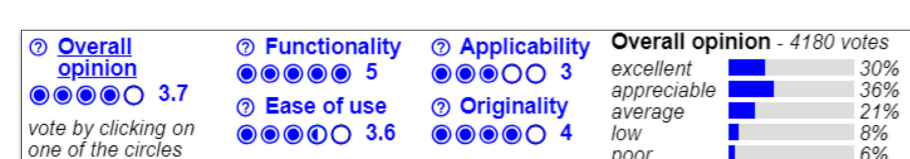
Based on zz-structure's ranks:

- Left/right arrows move to previous/next app in the current navigation set of applications (default: apps in the same category).
- Navigation window shows the list of the apps in the current navigation set.
- Select a new navigation set by clicking on the compass on top-right.
- Each criterion is marked with a color.
- Criteria can be combined with AND/OR operators; compound criteria are marked in yellow.

App Ratings

AppInventory collects user ratings about the apps on four aspects plus a general one:

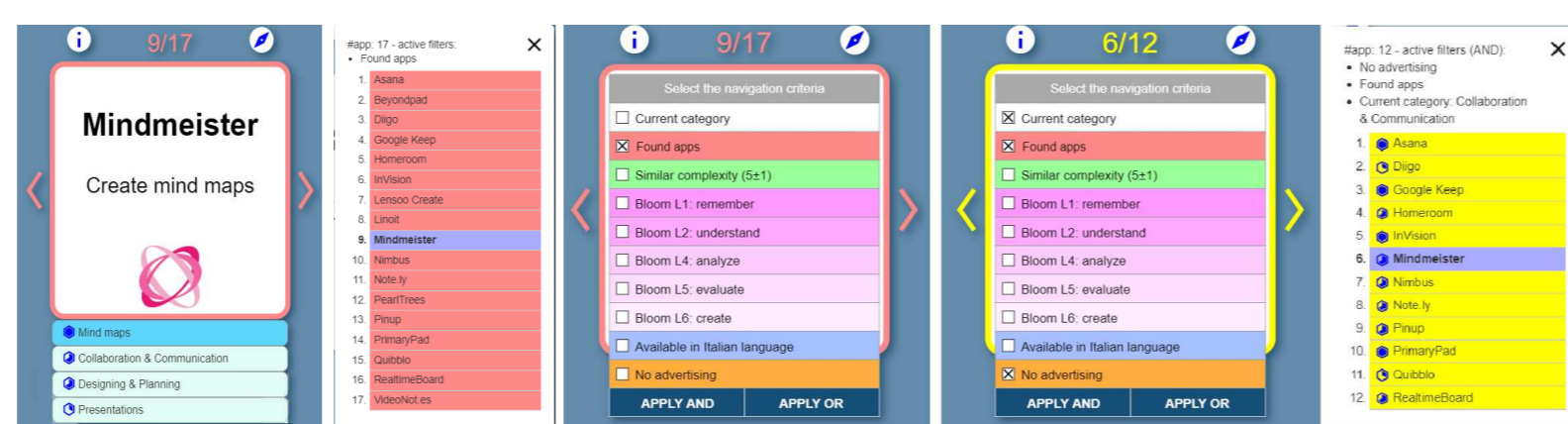
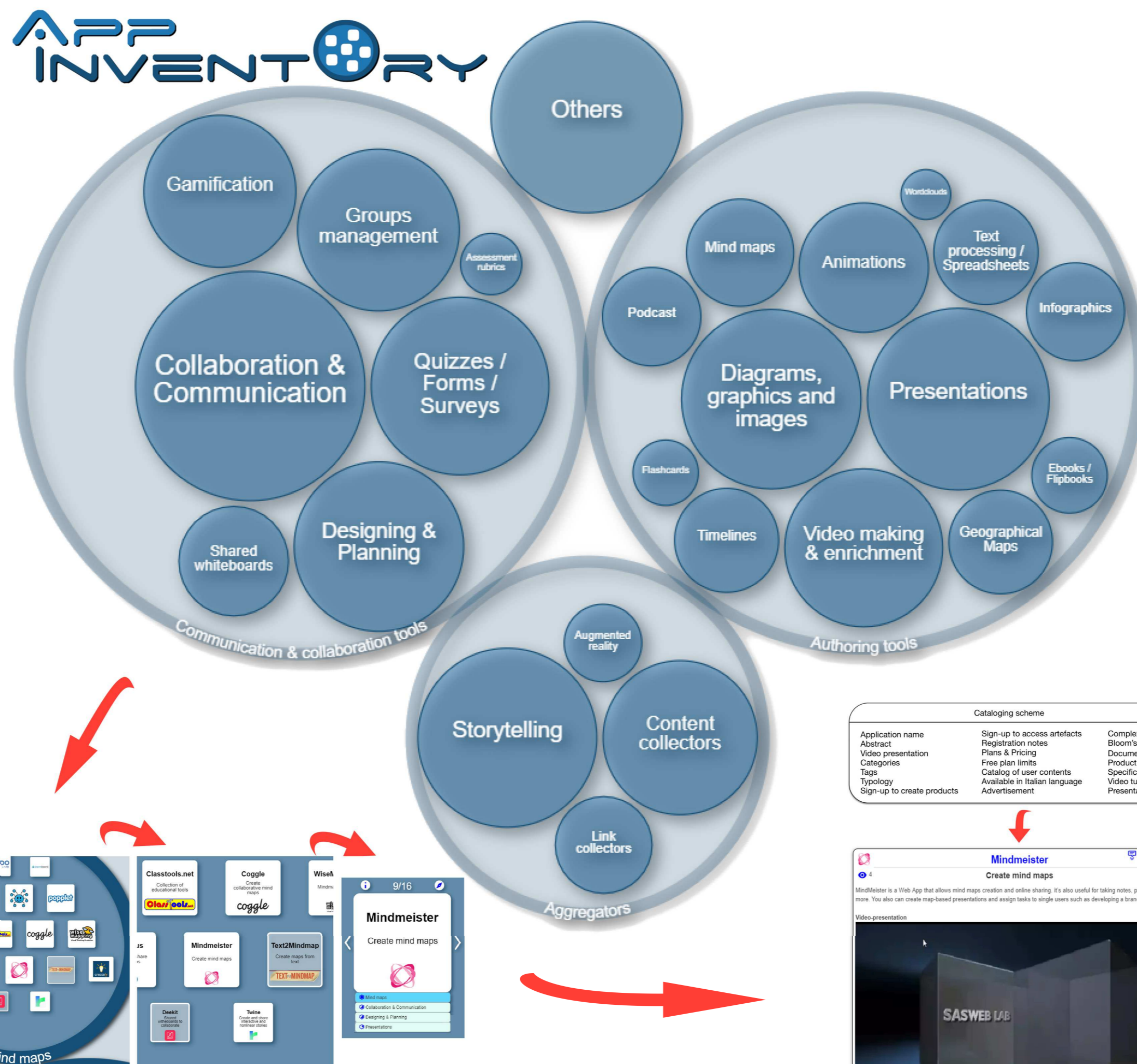
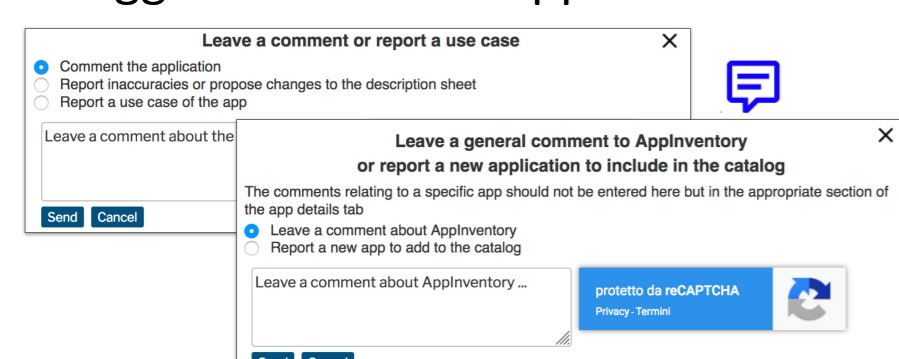
- functionality: versatility of the app or the richness of the features provided;
- applicability: adaptability of the app to multiple contexts and tasks;
- ease to use: usability and intuitiveness of the user interface;
- originality: refers to the features provided and/or the technical adopted solutions; overall opinion:



User Contributions

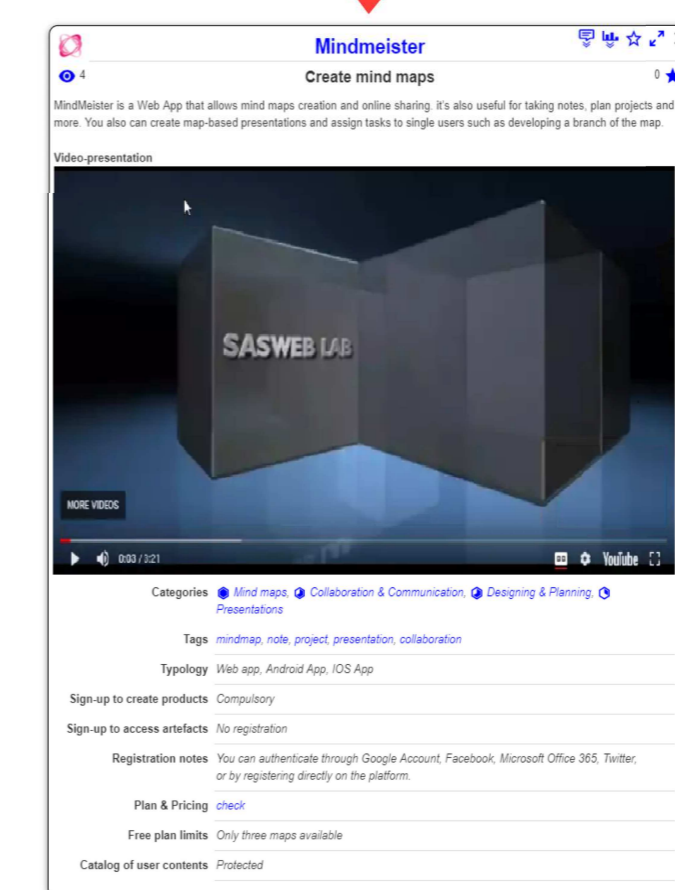
AppInventory collects users' contributions for the single app:

- comments;
- reports on description card;
- descriptions of original use cases;
- suggestions of new apps.



Cataloging scheme

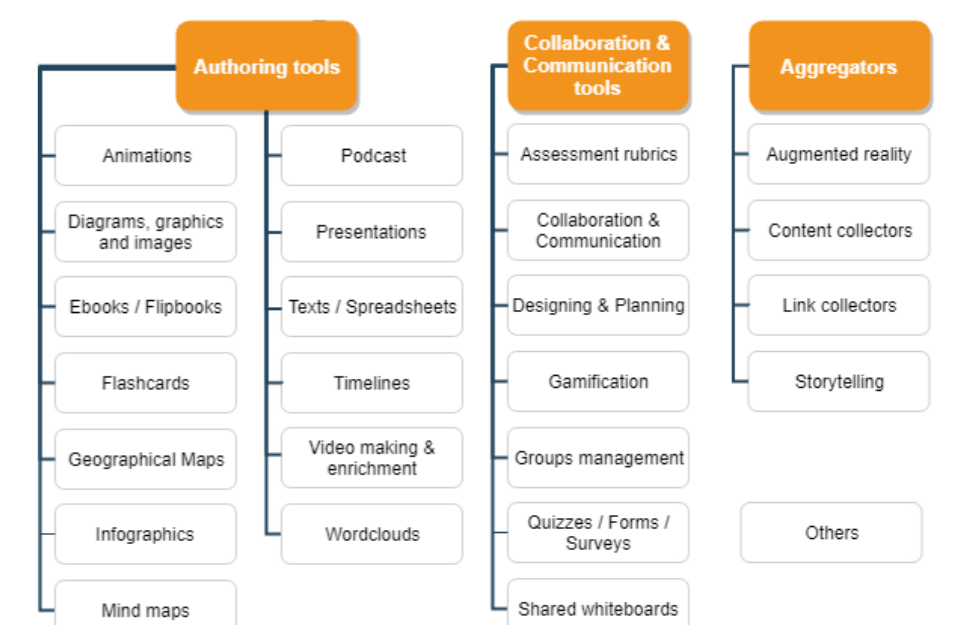
Application name	Sign-up to access artifacts	Complexity (1-10)
Abstract	Registration notes	Bloom's levels
Video presentation	Plans & Pricing	Documentation
Categories	Free plan limits	Product examples
Tags	Catalog of user contents	Specific subjects
Typology	Available in Italian language	Video tutorial
Sign-up to create products	Advertisement	Presentation



Purpose-based Taxonomy

On the basis of detailed analysis, we proposed a taxonomy organized in 3 macro-categories: Communication / collaboration tools, Authoring tools, and Aggregators.

At a lower granularity level, we identified 24 sub-categories. Due to the apps' hybrid characterization, the attribution to the categories is multiple and weighted.



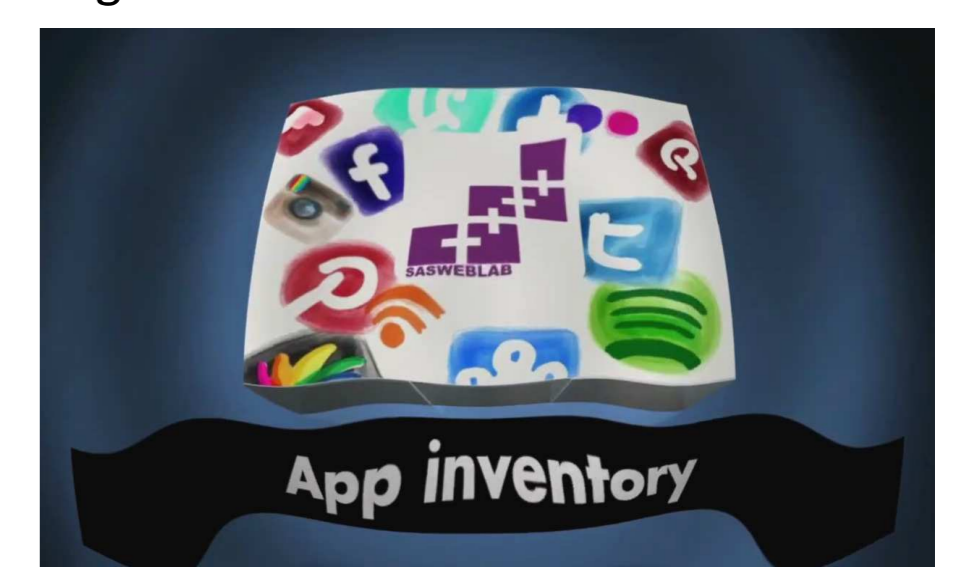
Cataloging Scheme

A set of significant features has been identified to describe each app. The presentation field illustrates, through text and images, the main sections of the app (home page, dashboard, authoring page, user profile, etc). All Information is available in Italian and English.

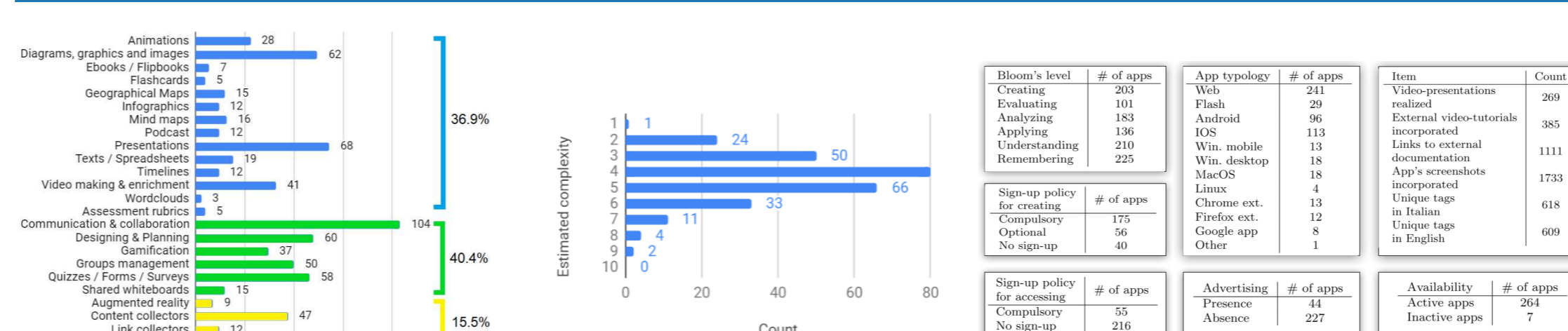
AppInventory Playlist

For each app a video-presentation has been realized and embedded in the description card.

All videos are also collected in the AppInventory playlist of the Sasweb YouTube's channel and provided with English subtitles.



Dataset Statistics



Preliminary User Evaluation

Sample of 53 persons (31 F, 22 M) who participated to the presentation of the platform and to a workshop session.

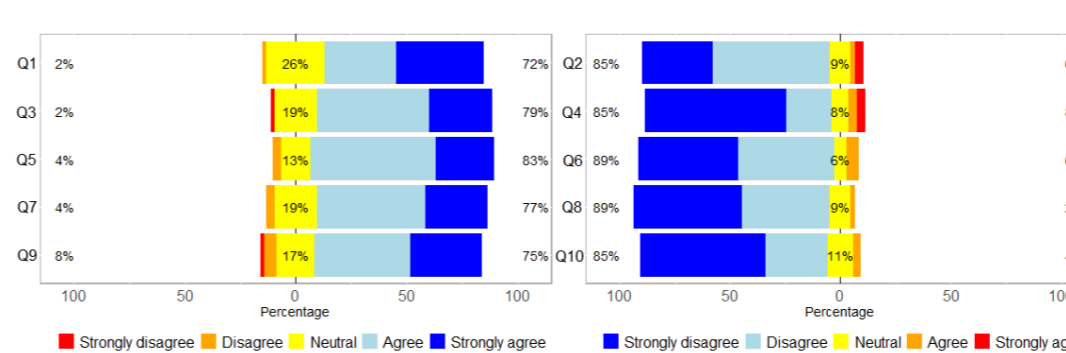
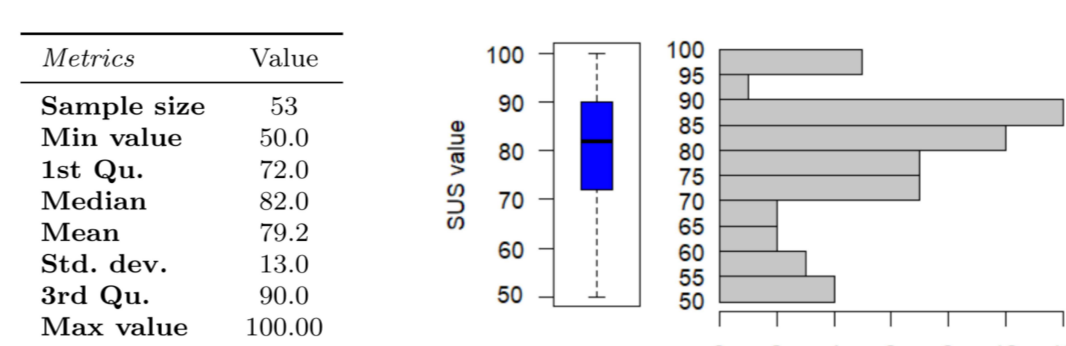
Professions:

- teacher/researcher: 70%;
- student: 17%;
- other: 13%.

Among teachers:

- 20.5% from primary school;
- 72% from high school;
- 5% from universities;
- 2.5% from other schools.

The figures show the distribution of the standard SUS (System Usability Scale) questionnaire and the details of the 10 questions/answers.



Bibliography

[1] Apps4edu. <http://www.uen.org/apps4edu>. Last visited 28 December 2018. [2] T. Cherner, J. Dix, and C. Lee, "Cleaning up that mess: A framework for classifying educational apps," Contemporary Issues in Technology and Teacher Education, vol. 14, no. 2, pp. 158-193, 2014. [3] T. Cherner, C.-Y. Lee, A. Fegely, and L. Santaniello, A detailed rubric for assessing the quality of teacher resource apps. Journal of Information Technology Education: Innovations in Practice, vol. 15, pp. 117-143, 2016. [4] Common sense education. <http://www.common sense.org>. Last visited 28 December 2018. [5] M. Corbato, Modeling and developing a learning design system based on graphic organizers, in Adjunct Publication of the 25th Conf. on User Modeling, Adaptation and Personalization. ACM, 2017, pp. 117-118. [6] M. Corbato and A. Dattolo, Appinventory: a visual catalogue of web 2.0 and mobile applications for supporting teaching and learning activities. In Proceedings of the 22nd International Conference Information Visualisation - IV 2018, Salerno, Italy, July 10-13 2018, pp. 530-535, IEEE. [7] A. Dattolo and F. L. Luccio, "A state of art survey on zz-structures," in Proceedings of the 1st Workshop on New Forms of Xanalogical Storage and Function, CEUR, no. 508, Turin, Italy, June 29 2009, pp. 1-6. [8] A. Dattolo and F. L. Luccio, "A formal description of zz-structures," in Proceedings of the 1st Workshop on New Forms of Xanalogical Storage and Function, CEUR, no. 508, Turin, Italy, June 29 2009, pp. 7-11. [9] Edshelf. <http://edshelf.com>. Last visited 28 December 2018. [10] Essediquadro. <http://sd2.itd.cnr.it>. Last visited 28 December 2018. [11] A. Jareno, E. M. Morales-Morgado, and F. Martinez, "Design and validation of an instrument to evaluate educational apps and creation of a digital repository," in Proc. of the 4th International Conf. on Technological Ecosystems for Enhancing Multiculturality, ser. TEEM '16. New York, NY, USA: ACM, 2016, pp. 611-618. [12] T.H.Nelson, "A cosmology for a different computer universe: Data model, mechanisms, virtual machine and visualization infrastructure," Journal of Digital Information, vol. 5, no. 1, July 2004. [13] The European Digital Competence Framework for Citizens. <http://ec.europa.eu/jrc/en/digcomp/digital-competence-framework>.

System Architecture

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