chi sparks 2014

The Kids' Knowledge Base: Connecting Junior Science to Society

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ABSTRACT

Universities try to reinforce their connections with society in many different ways. Introducing children to science at an early age is an important part of this mission. The online "Kids' Knowledge Base" is a key instrument for presenting showcases of various scientific fields to primary school children, thereby aiming to pique their curiosity. We outline the architecture and development process of the Kids' Knowledge Base, and describe how it is increasingly being embedded in an ecosystem of online and physical tools, stakeholder networks, and activities. We show how it has been used since its launch in March 2013, and discuss how combining different modes of offline and online interaction helps to promote its overall usefulness and use. We discuss some applications and extensions of the current digital infrastructure and how these may help increase the quality and quantity of the online interactions with the knowledge base.

Author Keywords

Science; children; knowledge bases; e-learning; social media; socio-technical systems; social innovation

ACM Classification Keywords

H.5.3 [Information Interfaces and Presentation] Group and Organization Interfaces - Asynchronous Interaction

INTRODUCTION

Universities traditionally have been inward looking in their educational process, only teaching their mature students science. Increasingly, however, they aim to reach out to younger, pre-university populations. One reason for doing so is that being immersed at a young age helps the knowledge worker generation of the future to be more competitive [1]. In the Netherlands, there exists a national network of so-called "science hubs", each associated with one or more universities. The mission of these hubs is to find innovative ways to get primary school-aged children interested in science. The manifold activities of one of these hubs, the Wetenschapsknooppunt Brabant (Science Hub Brabant) include, for instance, "kids' lectures", in which professors at the university give special lectures about their topics of specialization to groups of children; "kids' science books", in which professional science journalists interview researchers about their projects, then retell their stories in language comprehensible to children (and many adults); and a "Junior Science Café", in which researchers discuss their work with children, jointly performing small experiments with them.

A major drawback of these physical activities is that they are expensive and hard to scale. Instead of just having local and print activities, a project was started to try and find a way to develop a digital resource expanding the palette of activities. This resource would need to be accessible everywhere by everybody at any time. It was dubbed the "Kids' Knowledge Base".

This short paper is not intended to provide a theoretical framework for human computer interaction in science communication, nor to describe a statistically sound experiment on how children interact with particular online media. Instead, our goal is to introduce a real-world educational case – the Kids' Knowledge Base - that is all about how such ICTs may come to have true societal impact. In our case, ICTs are a critical enabler, yet they do not mean much without equally developing a solid social context around these technologies. Ours is really a case of social innovation, where (socio-technical) innovations necessarily go through a spiraling process of scaling up from small-scale initial inspirations, ideas, and prototypes to large-scale systemic impacts via a series of intermediate stages [2]. Each stage is a mix of planned interventions and unpredictable events that offer opportunities for (and possibly threats to) further growth.

Storytelling is a powerful tool for communicating complex knowledge management and organizational change processes [3]. Although our case is still very much unfolding, we would already like to share our story of the interventions and events that happened so far and which helped to shape the Kids' Knowledge Base. Although anecdotal, we hope our story may inspire similar development projects elsewhere, as well as research into more systematic principles for developing such society-oriented, living educational knowledge bases.

KIDS' KNOWLEDGE BASE: THE DEVELOPMENT

The following objectives were adopted at the outset of the project. The Kids' Knowledge Base (KKB) should:

- Enthuse children for science.

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Published in: van Leeuwen, JP, Stappers, PJ, Lamers, MH, Thissen, MJMR (Eds.) *Creating the Difference: Proceedings of the Chi Sparks 2014 Conference*, April 3, 2014, The Hague, The Netherlands.

- Develop scientifically valid content for curious children in primary school.
- Enliven content through activating conversational and work practices.
- Support and connect other science hub physical activities to the digital knowledge base.
- Make it a living knowledge base by developing a community of stakeholders around it, who continuously find new ways to use and feed the knowledge base and expand its network of applications and related activities.

Key stakeholders working directly with the KKB, besides the children, should be their teachers and parents (Fig.1). The teachers should be able to use the digital content of the KKB in class activities, while the parents should be able to process the same content with their children in one-on-one conversations at home.

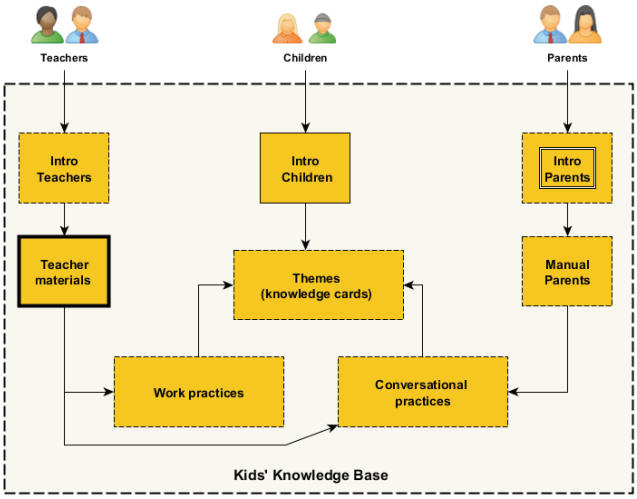

Figure 1. The Kids' Knowledge Base Architecture

The KKB contains a set of introductory knowledge modules ("kennismakingsmodules" in Dutch, which also has the meaning of "getting to know each other"), each introducing a different scientific field or area. Each module consists of a set of four or five themes, every theme in turn decomposed into a set of four or five "knowledge cards", explaining a particular topic belonging to that theme in a way comprehensible to primary school pupils. Each knowledge card has the following structure:

- Short introduction of the topic being presented
- Example
- Research related to the topic
- Research questions
- Advanced research (for very curious children)
- Related topics

Besides being organized by theme, knowledge cards also contain links to other cards, effectively creating a knowledge network. Of course, 20-25 cards cannot fully cover a scientific domain. In line with the project objectives, the purpose of a module is merely to pique a child's interest, then guide it to other (physical) science hub activities or more extensive digital materials, for example to be provided by libraries or publishers.

For parents, a simple manual suffices on how to have an informed discussion with their children using the digital knowledge cards. For teachers, a separate section was developed with additional open access learning materials, such as Powerpoint presentations that they can modify for their own classes, and tutorials explaining working and conversational practices to be used in promoting group discussions. At the teachers' request, this section was login-protected, to prevent children from downloading materials before class, so that the teacher can remain in control.

To produce a demonstrator of the KKB, a pilot was started to develop an introductory knowledge module for Philosophy. A teaching assistant (who was also a philosophy student) wrote the content for the cards, supervised by an established philosopher, so that the scientific value of the cards was guaranteed. Another teaching assistant then created the digital version of the cards, including providing them with a uniform layout.

TURNING A WEBLOG INTO A KID'S WINDOW ON SCIENCE

As the project team had only very limited development resources, it was decided to only use online platforms hosted in The Cloud. To develop the digital content, initially a Wikispaces wiki (http://wikispaces.com) was used. The advantage of this wiki was that it was easy to develop a content navigation structure, and jointly work on the rough content, including revision histories. However, for presentation and use purposes, this platform turned out to be less than satisfactory. A main drawback was the limited set of design options and templates, whereas a smooth presentation was key to enticing children to use it.

Development was then moved to a hosted WordPress site (Fig.2). Besides being an advanced content management system, WordPress sites are also standard-setting weblogs. Blogs are natural tools for promoting web learning [4]. A custom theme was modified, including a menu outlining the main themes of the knowledge module. On mouseover, the topic cards per theme become visible and clickable. The home page contains a photo carrousel with colorful pictures, each embedding an intriguing question that should get children interested. The initial color scheme was considered to be too boring by children participating in test panels. The colors were therefore made much brighter, with a purplish pink dominating – a color scheme loved by kids!

Figure 2. The Kids' Knowledge Base Home Page

Every knowledge card gets its own WordPress blog page. Each section of the page is preceded by an appealing icon, e.g. a colorful looking glass indicating the Research-section and a question mark indicating the Questions-section. Extensive use was made of YouTube videos, embedded in the blog page. A particular issue here was to look for fragments that are copyright-free, as several fragments initially selected turned out to be copyrighted Disney videos that were taken down by YouTube at some point.

The comments section that comes standard with each WordPress page was initially disabled. Although the team very much valued the feedback of children on the content, this would also mean actively monitoring and responding to those comments. As working with children is very sensitive, and no continuous capacity for moderating comments could be guaranteed, this option was switched off at first. However, a new project team member did not know about this policy and had activated the comments option. Since the feared and hard to manage spam-threads by kids "playing around" did not happen, we have left this option activated – for now.

Evaluation

Several versions of the site and learning materials were tested, in a classroom setting in a series of lessons, and in a lab test-session with four parent-child pairs. Each pair got their own PC. A 15 minute plenary introduction, was followed by a 30 minute free exploration of the KKB. The evaluation was concluded by a 15 minute plenary discussion. At those test sessions, each pair was monitored by an observer, logging their comments and responses as they explored the site. Some of these HCI observations, although anecdotal, are worth summarizing here, as they may inform similar projects:

Observations by children
"It's a nice way to learn a lot"

Many paragraphs contained too much text and too difficult words.

Some children skipped most of the text, others read everything. Some said that if they had been at home, they would have read everything.

The boys thought the original dominant pink color to be too "girlish", after which it was changed into a more purple hue.

The children all loved the YouTube videos.

Observations by parents
Texts should be short, fonts should be big.

Use more steps in navigating the scientific content.

Start with concrete content, only then introduce the more abstract concepts.

Use icons to indicate the (repeated) structure of the cards.

Should the parent guide the child (prepare beforehand) or follow the kid (as it follows its preferences)? Both routes should be supported.

Do away with distracting columns of other events, just focus on the content, otherwise you lose the child's attention.

An interesting (and in hindsight, predictable) clash between the classification-driven world of scientists and the "common-sense"-driven world of children was observed as none of the children in the test group would click the knowledge card which contained the word "teleology". When the title was replaced by "Does everything have a purpose?" it was much more palatable.

USING AND GROWING THE KKB

The KKB was launched in March 2013 (http://kinderkennisbank.nl), with a big launch event in the university auditorium. The event was discussed that same night at a provincial TV talkshow.

A cross-medial approach is used to promote the KKB, including a Facebook page and Twitter account. Increasingly, the other activities of the Science Hub, such as the Junior Science Café, start pointing to it and using it, for example, in preparation for an event.

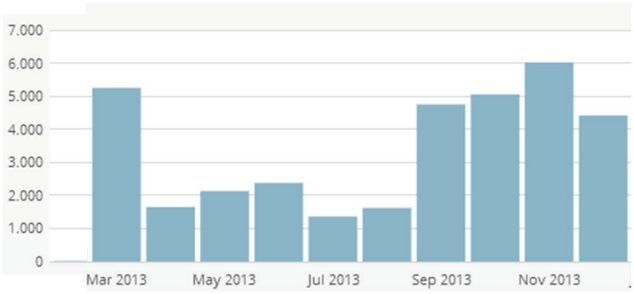

Figure 3. The Kids' Knowledge Base Page Views in 2013

Page views are surprisingly high and continue to grow, even though there is still only knowledge module (Philosophy) and there are no major PR efforts to promote the KKB. As of the writing of this article (March 10, 2014), there have been 54,272 page views, the highest ever being 1,271 page views, on average 217 per day. Unique visitors are also high, for example, November 2013, the peak month that year, counted 6,018 views and 2,728 unique visitors.

When looking at the monthly statistics, there is a significant increase of views in September 2013. This may be explained by a very interesting associated event held then, the "B@ttleweters Kids' Knowledge Battle". B@ttleweters (freely translated as "B@ttle Know-It-Alls"), was successfully launched during the European Social Innovation Week in Tilburg in September 2013. The format was developed by the provincial library innovation organization Cubiss, in association with Wetenschapsknooppunt Brabant. The knowledge battle combines the KKB with public library materials, services, and locations. Groups of children from participating schools prepare for the battle by working with the KKB in the classroom. In this way, they are taught both hands-on introductory science and media literacy skills. During the live battle, they go online to look up answers to questions

derived by librarians from the KKB, while using a public library "media bar" to get access to networked devices. They also debate a proposition in front of the audience. The children are wildy enthusiastic, as this evidence shows: http://battleweters.nl/

B@tlleweters is currently being developed into a full-fledged kids' knowledge battle format, for which interest has been shown by libraries and science hubs all over the country. This is a good example of scaling up the partner network around the KKB, towards reaching social innovation levels of "systemic impact". By embedding quite basic digital resources in a well thought-through context of physical activities, the quantity and quality of the interactions – and their impact on promoting science to kids - can thus be amplified significantly.

New knowledge modules are currently being developed, such as around the European Values Study being coordinated by Tilburg University (which has been monitoring the evolution of social norms and values in many European countries over the past decades) and one on emotions. For the latter, content from an existing "children's science book" will be repurposed by the (science journalist) author, and relevant fragments turned into paragraphs for knowledge cards. To make the experience more interactive, we are currently exploring the possibilities of an established interactive quiz platform (http://www.proprofs.com/). Key requirements are that children can take the quizzes anonymously and that their metadata do not contain personal information.

CONCLUSION

As Jackson states, universities are above all social institutions that are "an essential part of the fabric of a vigorous and dynamic civil society, both contributing to the wider life of that society and at the same time open to the impulses and energies flowing from that wider life [6, p.105]". Universities reaching out to children and getting them interested in science at a young age is an important role to play for such a social institution in the emerging Knowledge Society. We presented how the online Kids' Knowledge Base is becoming a relevant instrument for science education. We do so by developing online introductory scientific content, activating this content through applications like B@ttleweters, and developing a strong partner network of stakeholders.

Although the digital tools used are essential to enable the many (potential) interactions, the tools are only a small piece of the puzzle. A key question is how to embed these tools in a complex, evolving socio-technical context driving the use and evolution of the platform. In this way, the Kids' Knowledge Base is becoming a truly living socio-technical system, impacting society in increasingly powerful and surprising ways.

ACKNOWLEDGMENTS

The author would like to thank all members of the project team and the Kinderkennisbank Partner Network, in particular Cubiss, for their many contributions.

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