Wikipedia Primary School

Final report

This is a report on the results of the Swiss South African Joint Research Programme (SSAJRP), which is an applied research project developed by Swiss and South African collaborators that focused on developing and evaluating a system to assess Wikipedia articles for primary education and to involve a wide network of scholars and expert contributors in the process.

Acknowledgments

The research is developed within a Swiss-South African cooperation lead by the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) and the University of Cape Town, in partnership with Wikimedia Switzerland and the Africa Centre based in Cape Town, and with the support of SNF and the South African National Research Foundation (NRF).

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Links to research project

- Project description : https://meta.wikimedia.org/wiki/Research:Wikipedia_Primary_School_SSAJRP_programme
- Working pages on the English Wikipedia : https://en.wikipedia.org/wiki/Wikipedia:WikiProject_South_Africa/Wikipedia_Primary_School

Keywords

ICT in Education, Wikipedia, Primary schools, Universal primary school curriculum, ,South Africa, Methodological studies, Academic community, Wikipedia community, openness, access to knowledge, Open Education Resources, Africa

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The Wikipedia Primary School SSAJRP

Wikipedia Primary School is a project that works at providing on Wikipedia the information necessary to complete the cycle of primary education in the languages used by different national education systems (with a focus on developing countries, Africa specifically). It unfolded in several stages. The Swiss South African Joint Research Programme (SSAJRP) research, the object of this report, is the second stage in the framework of Wikipedia Primary School project.

The first stage was the WikiAfrica Primary School Feasibility Study that was conducted in 2012 and released in 2013. The purpose of the Feasibility Study was to establish a baseline report of the current state of Wikipedia languages and of primary school education in three countries, namely Italy, Cameroon and South Africa. It first focused on all languages that are used in each of the African countries' school systems. It then conducted an accurate quality assessment of the articles that were relevant to primary school curriculums in the English, French, and Italian language versions of Wikipedia. Amongst other activities, a case study about South Africa observed the peculiarity of the current South African primary school environment. The case study assessed the impact of the emphasis, post-apartheid, on outcomes-based education, the 11 official languages, the situation around schoolbooks and infrastructure, and the challenges in evaluating and improving the system. It also assessed active Open Education Resources (OER) and other digital solutions.

The key findings of the Feasibility Study[1], and in particular the extended Primary report (WikiAfrica 2013) outlining South Africa's Primary School landscape and the potential impact of Open Education Resources (OER) and the potential of Wikipedia as a support resource for curriculum-aligned content creation and dissemination[2], were used to develop the SSAJRP research project.

The applied research of SSAJRP was developed within the frame of a Swiss–South African partnership. The collaborators focused on developing and evaluating a system to assess the suitability (with regards to primary education) of the relevant Wikipedia articles, and to involve a wide network of scholars and expert contributors in the process. Key activities of the project included:

1. Developing the necessary framework to identify, address and involve key stakeholders (e.g. the Wikipedia community, partners, volunteers, scholars and experts in the field of education);
2. Selecting relevant articles which respond to curriculum-based questions and focuses; and
3. Facilitating the expansion or production of additional high-quality and assessed articles on Wikipedia that are specifically linked to primary education.

[1] The Primary School Feasibility Study. The study was published in November 2012. It produced a quality and quantitative assessment of Wikipedia editions in the languages used for instruction in Africa and three case studies about primary school in Italy, South Africa and Cameroon and include a list of key findings specifically related to the WikiAfrica Primary School project. https://meta.wikimedia.org/wiki/File:WikiAfrica_Primary_School_-_Feasibility_study_November_2012_(draft).pdf

[2] The Primary Report stand for "The Primary Report on Primary School in South Africa and its ICT readiness". The Primary Report was part of a much larger Feasibility Study for WikiAfrica's Primary School project, that was funded by Lettera27 and project managed by Iolanda Pensa. The South African study was conducted in South Africa by the Africa Centre. The Primary Report was compiled and written by Isla Haddow-Flood and Kelsey Wiens. The Primary Report was also designed and set by Isla Haddow-Flood. https://commons.wikimedia.org/wiki/File:Primary-report_final_sm.pdf.

1. Context

Primary education

Primary school education establishes a solid grounding for the development of personality. It provides the tools and concepts through which students can understand the world, can access higher education, and develop the basic skills to engage in entrepreneurship and the workplace. In primary school pupils acquire and apply knowledge, skills, and disciplines that achieve educational goals, rather than a simple set of notions. Primary school curricula focuses on literacy and numeracy. This knowledge should be provided in examples that need to be meaningful and relevant to the pupils' own lives. In this way, the context of the content is vital. Content should be related to life skills and focus on citizenship. The content fosters the capacity to understand the complex reality of the world across a variety of disciplines, including geography, history, natural sciences, languages, mathematics and technology.

Primary school education was at the centre of the United Nation's 2000-2015 Millennium Development Goals (MDGs). Of particular relevance were goal number 2 that aimed to achieve universal primary education, and goal number 3 that was related to the promotion of gender equality and women's empowerment. The 2012 EFA Global Monitoring Reports states that "on current trends, the goal of universal primary education (UPE) will be missed by a large margin" (UNESCO 2012, 3). Indeed, the MDG Report 2015 outlined that the primary school net enrolment rate in the developing regions had reached 91 per cent in 2015, up from 83 per cent in 2000 (UN 2015). A threshold of at least 97 per cent is frequently used to determine whether universal enrolment has been attained. Based on this threshold, the target is close to being reached in all regions except sub-Saharan Africa. Moreover, a study released in November 2012 by UNICEF forecasted a 4% increase in the global population of children by 2025. By 2050 "1 in every 3 births – almost 1 in every 3 children under 18 – will be African"(UNICEF 2012, 3). According to the MDG report, Sub-Saharan Africa "has had the best record of improvement in primary education of any region since the MDGs were established" (UN 2015, 4), with a net enrolment rate from 60 to 80% in 15 years. In some Sub-Saharan African countries, the population of school-aged children is expected to double between 2010 and 2025 (ibid.).

Accordingly, in 2013 the team developed a research project that was specifically focused on primary school education and access to knowledge. The research project focused on on South Africa. South Africa is particularly interesting because of its contradictions – good practices were set up, however there are surprisingly poor outcomes.

The South African primary education

The quality of South Africa's primary school education was placed at 126th out of 144 countries by the World Economic Forum's (WEF) Global Competitiveness Report 2016/2017. The 2016-7 report mentions that there has been a small but important upgrade in the quality of education (up five places), with national primary school enrollment now passing 97 percent (WEF 2016).

This shows a marginal improvement on the state of primary education as assessed in 2013 by the Primary Report by WikiAfrica in 2013. At this time, South Africa's primary school education was rated at 132rd out of 144 by the same organisation*:*

> "With the strong legacy of apartheid education, policy-driven decisions and poor leadership, South Africa's public education is at a tipping point. Education is making the headlines daily,

> from absentee teachers to illiterate students, to shocking infrastructure. The dysfunctional nature of the system has created further disadvantages in the labour market which is further entrenching poverty. Making the cycle nearly impossible to break." (WikiAfrica 2013, 7)

In 2017, South Africa's education system continues to struggle with deficient administration, rampant corruption, and the significant resources annually earmarked for education not achieving effective results. Nic Spaull argues that with no "tangible consequences for non-performance, there now exists a cycle of poor service delivery, weak accountability and low expectations" (Spaull 2015, nd). This raises critical issues for the country. Currently more than 50% of young adults are unemployed and largely unemployable due to a lack of basic skills. Maths and science education are rated in the lowest 5% of all education systems worldwide, and 60% of learners who begin their school careers at Grade 1 do not sit Matric (the final secondary school qualification).

As with many aspects of South Africa's society, the content for the curriculum is seen as highly political. The South African curricula for primary education has been developed to specifically focus on local and national history at the expense of a broader international focus. The Feasibility Study expressed the desire for teachers to provide students with a broader sense of world history, as a balance between local, national and international content. This was seen as essential.

But content and skills related to primary education do not only refer to those received by the children. Primary education not only teaches previously disadvantaged adults, but also provides on-going opportunities for lifelong learning, and skills development and maintenance for teachers. Teachers are pivotal members in any education system. They bear the weight and responsibility of teaching, and, apart from parents, are the main source of knowledge and values for children. According to a report released by the Centre for Development and Enterprise (CDE) in September 2011, South Africa is in dire need of good, skilled teachers (McCarthy *et al.* 2011).

Another considerable ongoing challenge is that schoolbooks are not available to all students and Open Education Resources are not available to all teachers. Relative to neighbouring countries, South Africa puts significant resources towards educational materials. However the results from South Africa shows the severity of the situation with regards to digital resources. Teachers require additional training and teaching materials in order to develop effective content and enable primary schools to reach their full potential. There are minimal Open Education Resources aimed at primary school as OER focus in South Africa has been on secondary and tertiary levels. In 2004, South Africa released a White Paper on e-Education, yet rollout has been sporadic with computers or the much vaunted tablets remaining in the office, or being used for administrative support (Department of Education SA 2004). The ICT in Education survey in 2007 reported that only 6% of classrooms had computers connected to the Internet and were used by learners who do CAT (Computer Application Technology) as a subject (Isaacs 2007).

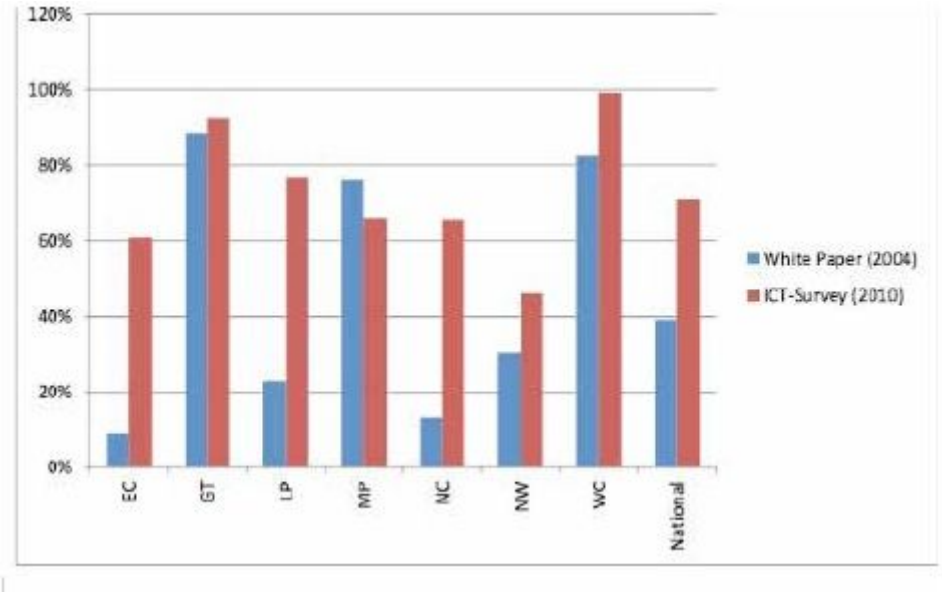

Figure 1: ICT in Schools 2004 and 2010. Source: Survey of ICT in Schools in South Africa 2012

South Africa's education landscape is made from a broad ecosystem of institutions, people and stakeholders. Wikipedia has the potential to respond to curriculum-based questions in all countries of the world, from Primary School Education to Higher Education. As the 5th most used website globally, Wikipedia is already a major contemporary and mainstream source of information.

Wikipedia

With nearly 500 millions readers, 295 linguistic editions and more than 40 million articles, Wikipedia is the largest and most used encyclopaedia and an incredibly powerful educational tool. Its content can be freely used, reused and modified for commercial and noncommercial purposes. Almost all the official and "permitted" African languages of the local educational systems have a Wikipedia edition. Beyond the website itself, Wikipedia is accessible on mobile phones for free in numerous countries thanks to the project Wikipedia Zero. Itis accessible offline on USB-key, DVD and plugs with the specific offline interface Kiwix, and is already distributed in schools thanks, in particular, to One Laptop per Child (OLPC), local Wikimedia chapters activism and Afripedia (a project of Wikimedia France).

Wikipedia is based on an openly editable model called a wiki. It is written collaboratively by largely anonymous Internet users who write without pay. Anyone can write and make changes to Wikipedia articles – anonymously, under a pseudonym, or stating their real identity. The result is a live collaboration that differs from printed encyclopedias: Wikipedia is continually created and updated, with articles on historic events appearing within minutes, rather than months or years. One of the main assumptions is that contribution is more important than the expertise of the contributor.

Wikipedia constitutes a valuable resource, but it does not yet provide content relevant to Primary School curriculum-based questions in African education. There are several limitations to the use of Wikipedia in Primary School Education in South Africa.

First, though not specific to South Africa, Wikipedia is an encyclopaedia, not a schoolbook. It requires a certain degree of education to be consulted. Also, the first years of primary school are commonly taught in local languages and teachers often face difficulties in teaching in official languages when different from their mother-language.

	Gr 1	Gr2	Gr3	Gr4	Gr5	Gr6	Gr7	Gr8	Gr9	Gr10	Gr11	Gr12	SA
Afrikaans	9.5	9.6	9.9	12.3	12.2	12.2	13.2	13.1	14.0	12.7	12.1	12.8	11.9
English	21.8	23.8	27.7	79.1	81.1	81.6	80.6	80.9	80.0	81.2	82.0	81.4	65.3
IsiNdebele	0.7	0.8	0.8	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.4
IsiXhosa	16.5	15.0	14.0	3.1	2.5	2.0	1.9	1.6	1.4	1.3	1.2	1.5	5.5
IsiZulu	23.4	21.7	20.1	1.5	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	6.8
Sepedi	8.3	9.1	9.2	1.1	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	3.1
Sesotho	4.7	4.8	4.4	0.5	0.4	0.3	0.4	0.4	0.5	0.5	0.4	0.3	2.4
Siswati	2.1	2.1	1.7	0.4	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.7
Tshivenda	2.2	2.4	2.4	0.3	0.2	0.2	0.2	0.4	0.5	0.5	0.6	0.5	0.9
Xitsonga	3.1	3.3	3.1	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	1.4
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 1 : Percentage of learners by Language of Learning in 2007 (DBE, LOT Report 2010)

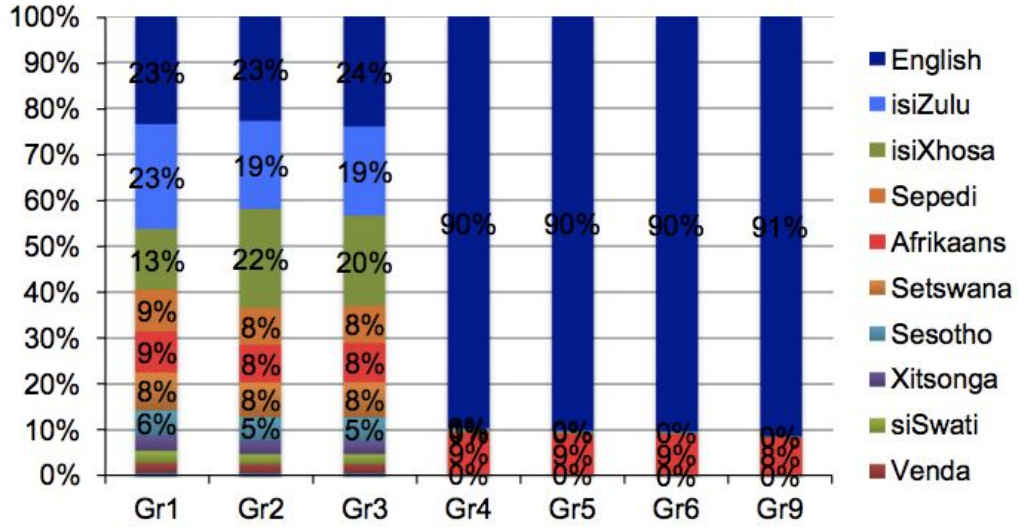

Figure 2: Breakdown of the language of learning, teaching and assessment by grade, Annual National Assessment (ANA) 2013 various grades (n = 7,630,240) (Pretorius and Spaull 2016)

Wikipedia in English presents a higher number of articles and qualitatively better articles than any other language edition, whilst most of the African local language editions are very small and with low participation (Gilfillan 2016) .

African Language Wikipedias

LAN-GUAGE	11/2/2011	9/5/2013	26/6/2015	5/3/2016	24/11/2016
Malagasy	3,806	45,361	79,329	81,240	82,799
Afrikaans	17,002	26,752	35,856	39,065	42,732
Swahili	21,244	25,265	29,127	32,565	34,613
Yoruba	12,174	30,585	31,068	31,172	31,483
Egyptian Arabic		10,379	14,192	14,839	15,959
Amharic	6,738	12,360	12,950	13,031	13,279
Northern Sotho	557	685	1,000	2,830	7,605
Somali	1,639	2,757	3,446	3,878	4,322
Kabyle		1,503	2,296	2,643	2,847
Lingala	1,394	2,025	2,062	2,131	2,777
Shona		1,421	2,321	2,459	2,638
Kin-yarwanda		1,817	1,780	1,785	1,799
Hausa	-	-	1,345	1,360	1,400
Igbo	-	-	1,019	1,112	1,284
Kongo	-	-	-	1,122	1,173
Luganda	-	-	-	-	1,082
Wolof	1,116	1,161	1,023	1,044	1,058

South African Language Wikipedias

LAN-GUAGE	19/11/2011	9/5/2013	26/6/2015	5/3/2016	24/11/2016
Afrikaans	20,042	26,754	35,856	39,065	42,732
Northern Sotho	557	685	1,000	2,830	7,605
Zulu	256	579	683	742	777
Tswana	240	495	503	538	615
Xhosa	125	148	356	473	576
Swati	359	364	410	412	419
Tsonga	192	240	266	352	390
Sotho	132	188	223	299	341
Venda	193	204	151	228	238
Ndebele (incuba-tor)	-	-	-	12	12

Table 2 : Trends in development of African languages and SA languages Wikipedias from 2011 till 2016. Source: Ian Gilfillan 2016. http://www.greenman.co.za/blog/?p=1980

Second, Primary schools still face major challenges in many african countries: lack of adequate infrastructures (with of course very limited access to computers), large classes, teachers' absenteeism and lack of school books and libraries (WikiAfrica 2013).

Thirdly, on Wikipedia the articles that introduce general topics, of particular interest for Primary School Education, tend to be of lesser quality than articles on specific topics according to Wikipedia Quality Assessment research[3].

Lastly, Wikipedia presents an over-representation of the so-called Western-based subjects and an under-representation of the subjects related to the so-called "Global South" (Ford 2011; Van Deursen and Van Dijk 2011; Graham 2011). This is largely due to an overrepresentation of Western-based editors on Wikipedia and nearly half of the contributors to Wikipedia come from the United States, United Kingdom, Germany, France, and Italy (Graham et al. 2015).

[3] This is explicitely reported by Wikipedia meta contributors at the following links:
https://meta.wikimedia.org/wiki/Wikipedia_Primary_School/Languages
and https://meta.wikimedia.org/wiki/Wikipedia_Primary_School/Review

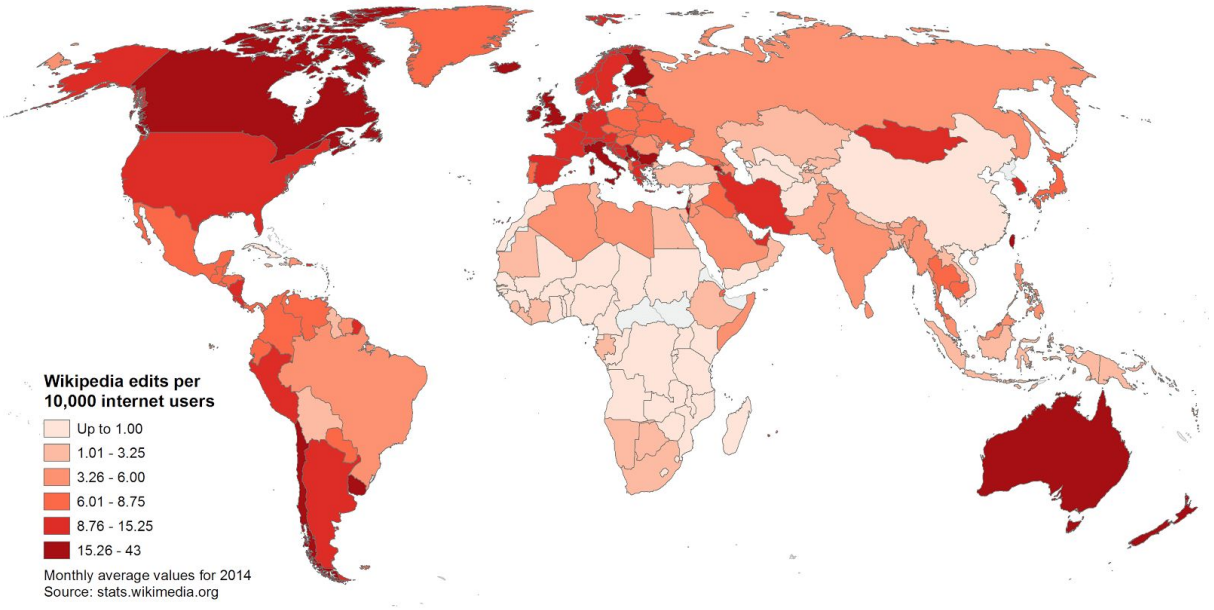

Figure 3: number of Wikipedia edits per 10000 internet users in 2014.
Mark Graham at Oxford Internet Institute.
Source : http://www.zerogeography.net/2012/02/where-do-wikipedia-edits-come-from.html

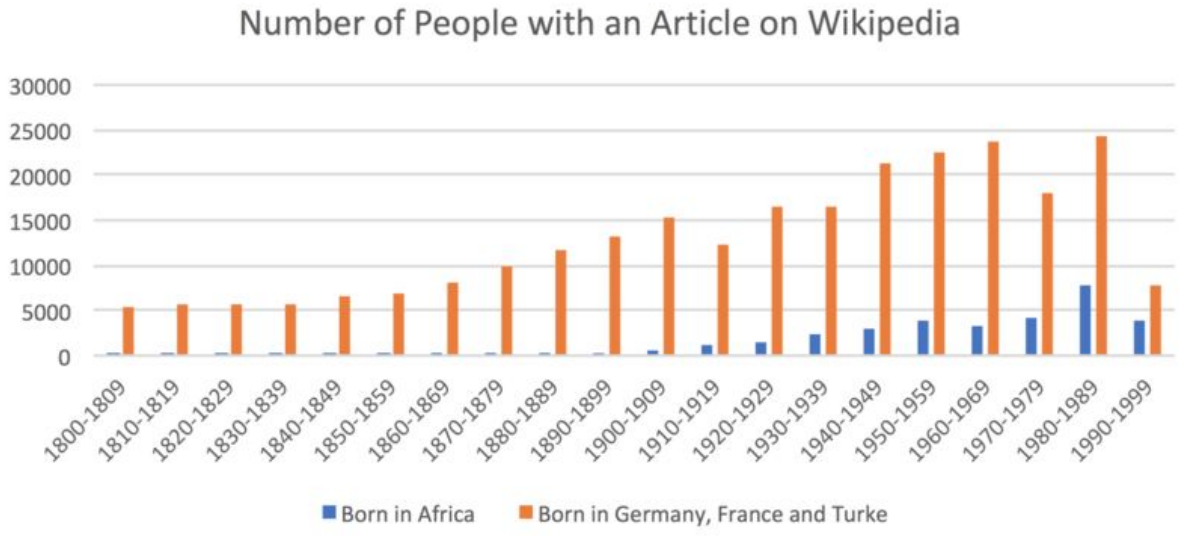

Figure 4 : Number of people with an article on Wikipedia - comparison between Africa and Europe (Germany, France, Turkey: the three current most populated countries). visualisation made within the framework of Workshop Wikidata SUPSI. February 2017. Authors: Profeta and Frei. Source : https://commons.wikimedia.org/wiki/File:SUPSI_workshop_on_Wikidata-notable_people_on_Wikipedia.png

2. Milestones in the research project

It was important to set specific milestones to drive the methodology behind the research project. These were:

1. Analysis of the South African primary school curriculum and identification of relevant themes and content.
2. Identification, selection and involvement of a scientific committee comprised of international subject-matter experts (education, open content, OER, Wikipedia and Wikimedia, expertise on African topics) to assist with content-related questions.
3. Identification of Wikipedia articles in English that are relevant to the South African primary school curriculum with feedback from the scientific committee.
4. Development of guidelines for the review process.
5. Development of a survey to involve teachers in the process.
6. Drafting of Issue 0 ("pilot issue") of the Wikipedia Scientific Journal.
7. Identification of academic experts and pertinent scientific journals to contribute to the review process of the Wikipedia articles selected.
8. Launch of the review process. Selection of articles and invitation of potential reviewers to review articles. 25 experts are currently involved in the review of 37 articles.
9. Pilot launch of the journal review process. Selection of articles, identification of potential journals, and invitation to review articles.
10. Development and testing of approaches to trigger article creation and improvement directly on Wikipedia.
11. Selection of criteria and data collection for the evaluation (information design).
12. Organization of three events (edit-a-thons) in South Africa to improve articles related to primary school curriculum. 17 articles have been edited and expanded.
13. Meetings in South Africa (Cape Town and Johannesburg) to discuss project methodology and expected outcomes with around 15 stakeholders working in the education sector as well as 30 Wikimedia community members.
14. Implementation of a tracking system to measure the impact of the different approaches implemented to trigger article creation and improvement.
15. Qualitative and quantitative evaluation of the results of each approach implemented.
16. Data visualisation of outcomes.
17. Final meeting to discuss the project's methodology, findings and models for replication with team members and stakeholders.

3. Methodology

As briefly outlined above, although Wikipedia constitutes a valuable resource, it does not yet provide content relevant to Primary School curriculum-based questions in African education.

The applied research project Wikipedia Primary School focused on developing and evaluating a system to assess Wikipedia articles for primary education, to test a set of methodologies that contributes to bridging the primary school education gap and Wikipedia content, and to involve in the process a wide network of scholars and expert contributors.

Key activities of the project include:

1. Developing the necessary framework to identify, address and involve key stakeholders (e.g., the Wikipedia community, partners, volunteers, scholars and experts in the field of education). This included establishing a Wikipedia Scientific Journal, and partnerships with scientific journals, scholars and institutions working in education.
2. Selecting relevant articles that respond to curriculum-based questions.
3. Facilitating the production of additional high-quality and assessed articles on Wikipedia linked to primary education. The project team developed then tested a set of methodologies heading toward two main directions: triggering content production by volunteers and making new content available from experts.

3.1. Creation of a dataset from existing Wikipedia articles, relevant to South Africa Primary School curricula

We identified topics related to the South African curriculum based on expectations presented in the South African Revised National Curriculum Statement Grades R-9 (Schools)[4] and then we selected existing Wikipedia articles related to those topics. The resulting list of articles has been reviewed and refined by a scientific committee of twenty experts, composed of a heterogeneous group of South African and international stakeholders. Experts included scholars and researchers selected for their expertise in the field of ICT and education, primary school education, experts on Wikipedia, and the teachers and parents at two primary schools.

The initial list of identified topics and the project in general was presented at a meeting that drew people working within the field of education (education organisations, teachers and educators) in Cape Town, South Africa on the 19 June 2014. The attendees were asked for their help in adding key topics to the subject list and to review the structure of the project.

This preliminary identification phase of topics and articles generated a dataset of content with two levels of topic specifications (41 general topics and 120 more specific topics) from the South African curriculum, and a list of 183 Wikipedia articles[5]. This dataset became the main working document of

[4] The South African Revised National Curriculum Statement Grades R-9 (Schools) was published by the Department of Education in May 2002 (Gazette No. 23406, Vol. 433; in the following they are references as NCS), and then double-checked against the indications contained in the Curriculum and Assessment Policy Statement for the Intermediate Phase (version published in 2011; CAPS).

[5] A full list of the 183 articles is available in the appendix at the end of this document.

the research team. The first selection of existing articles was made in September 2014, and improved in June 2015. New articles were created during the course of the project.

Photo 1 : Meeting of the research project Wikipedia Primary School in Cape Town, 19 June 2014. CC-BY-SA 3.0. Author: Iolanda Pensa https://commons.wikimedia.org/wiki/File:Wikipedia_Primary_School_meeting_June_2014_-_education_and_focus_groups_01.jpg

3.2. Introduction to the various strategies implemented

Based on the list of 183 articles, the research developed progressively over two years testing different methodologies that were aimed at improving at least 100 articles from our dataset.

The first part of the research consisted in developing a review process. During this stage, 136 academic experts and 25 pertinent scientific journals were identified and invited to contribute to the process of reviewing the Wikipedia articles that were related to their expertise.

Secondly, the team organised three events (edit-a-thons[6]) in South Africa with stakeholders who were working in the education sector to improve selected articles related to primary school curriculum.

Concurrently, another set of strategies were explored. This consisted of relying on the English speaking wikipedians to improve the dataset of selected articles online. The Wikipedia community has identified and developed various online tools and practices over the past 16 years to facilitate collaboration and content production. We selected, implemented, and then measured the impact of some of those approaches to trigger article creation and improvement directly onto Wikipedia by the volunteer community.

[6] In the online communities of projects such as Wikipedia, an *edit-a-thon* is an event where editors get together to edit and improve a specific topic or type of content, typically including basic editing training for new editors. The word is a portmanteau of "edit" and "marathon"

Each methodology included a series of strategies and activities developed under the frame of the same methodological scope. The table below provides an overview of methodologies and the related activities applied. Complete description of the methodologies implemented may be found immediately below.

Methodology	**Steps**
Review content	Identify and contact academic experts Identify and contact scientific journals Request a preliminary review of the article by the Wikipedia community Retrieve the article; article then sent to the expert along with a feedback form Collect the expert reviews
Publish the expert review	Upload expert reviews on Wikimedia Commons Copy and paste the expert reviews on the Talk page of the related article Request that OTRS[7] record authorship and licence
Full article rewritten by an expert	Copy edit the article as produced onto Wikipedia Request that OTRS record authorship and licence
Request an assessment (or reassessment) of an article by Wikipedia community	Review and record the assessment of each article on the different WikiProject that it belongs to Compare and evaluate all assessments Identify and select articles to ask for (re)assessment Implement actions advised by re(assessment) reviews
Call for new article creation	Propose articles to the Wikiproject “Requested Articles” page
Feature articles on Portal pages to encourage action	Select relevant portals Select which articles to add on which portal page Add articles to portal pages to encourage action
Call for action in related online community writing contests	Suggest the creation of articles’ in two writing contests
Edit-a-thons organised by the South African team	Identify dates and venue Identify articles to be created or improved Organise, communicate and advertise the events
Edit-a-thons organised by other parties	Track planned meet-ups Contact organisers of planned events Add targeted relevant articles to task forces’ lists

Table 3: Summary of the methodologies implemented to improve at least 100 existing Wikipedia articles covering topics considered notable both from the scientific and Wikipedia community.

[7] OTRS: Open Source Ticket Request System. More information about OTRS in the Terminology section at the end of this report

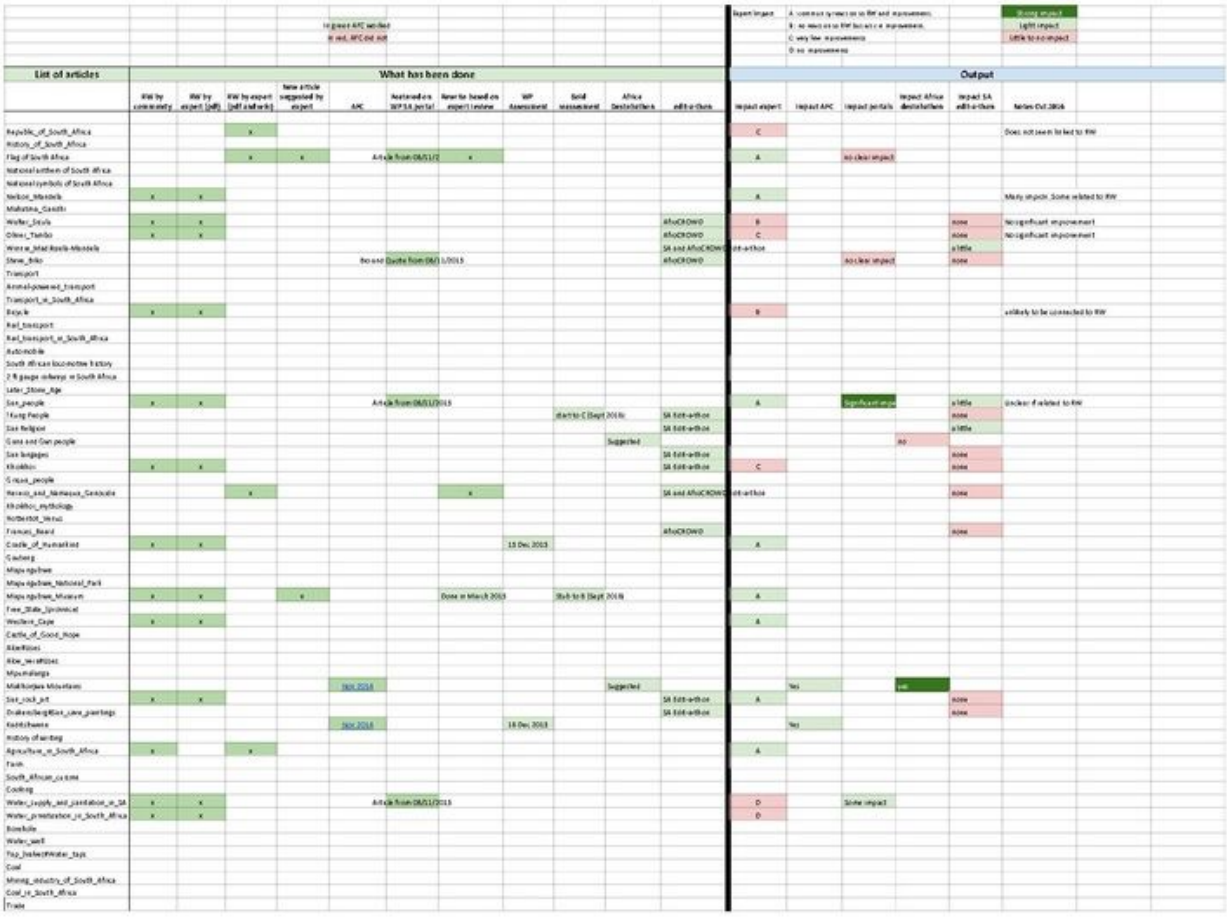

Figure 5 : methodologies applied to each Wikipedia article during the research.[8]

Review of content

The "Review" methodology was a collection of requests to review existing Wikipedia articles by a) Wikipedia community members, b) academic experts, and c) scientific journals.

Identification and contact of academic experts

Academic experts were identified in the following ways:

a. By their academic records, through online desk research: from google.scholar and online providers of scientific information – such as Elsevier.com – to universities' website;
b. For their participation at conferences and meetings on African Studies (ECAS 2015, Swiss Researching Africa Days 2014, Migration of Knowledge 2014, etc.);
c. By their academic records on African Studies Centres and digital libraries (the Centre for African Studies at the University of Cape Town, the African Studies Centre of Leiden, and the website South African History Online);
d. Through references and suggestions by academic experts involved in, or identified during, the process.

Potential reviewers were contacted by email and invited to review one or few articles. Five batches of

[8] Methodologies applied to each article: Download the full document:
https://commons.wikimedia.org/wiki/File:LifeTime_of_a_Primary_School_Article.pdf
Access working document :
https://docs.google.com/spreadsheets/d/1lFfeKmthE0PMuMiOZMqEve6uKaU5DiY0juw0td5XvWA/edit#gid=838484359
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approximately 30 emails were sent (December 2014, March 2015, July 2015, October 2015, and February 2016) in order to efficiently manage the flux of communication with the experts.

Identification and contact of scientific journals

Twenty five scientific journals were contacted to review Wikipedia articles related to the South African primary school curriculum on the basis of their specialist subject. Ninety four Wikipedia articles were proposed to scientific journals, of which 23 articles were proposed twice and one article three times, for a total of 119 review requests for articles[9].

Journals were contacted over two different periods using different strategies:

1. December 2015

In the first phase, 11 scientific journal were identified and contacted. They were selected from online desk research on the journal platform elsevier.com on the basis of their speciality and their provenance (journals from Africa were privileged in the selection process). The selection included: seven peer-reviewed academic journals from Africa (6 from South Africa and one from Nigeria) and four Western-based journal (two from the US, one from the UK, and one from Canada).

Of 11 journals only four are open access. Editors in chief and/or the editorial team were contacted by email and invited to participate in a "Call for journal experts for South African topics on Wikipedia". They were introduced to the Wikipedia Primary School project and its main goal of fostering better-quality articles on Wikipedia that are relevant to the South African primary school curriculum. A list of articles to contribute – between five and seven articles for each journal – was provided, with a total of 67 articles to review across all journals.

Editors were informed about:

i) a similar initiative which involved scientific journals contributing to Wikipedia articles (the Public Library of Science (PLOS)[10] created Wikipedia sessions around biology using "Topic Pages" that were written in the style of a Wikipedia article and peer reviewed by experts);
ii) the potential global visibility of their contribution;
iii) the open license CC-BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0/) under which their contribution should have be provided; and
iv) the possibility to host articles outside the journal (in the Wikipedia Scientific Journals) with proper attribution.

2. May 2016

In this second phase the research team employed different strategies in the selection of which journal and editors to approach. The journals were selected based on their African provenance and if an open access licence was applied. They were mostly identified from the interactive map of *Open Access Options: Journal* (Fig. 6) produced in the frame of the OpenUCT Initiative and compiled by Sarah Goodier (2013) that lists the creative commons licensed, accredited journals that are published or co-published in South Africa.

[9] The full list of journals contacted and the related articles of Wikipedia proposed may be seen here: https://docs.google.com/spreadsheets/d/1ZYeygCQTFX6wycDUtV_vIx4ET_IMo02_qDPJhF61rFY/edit?usp=sharing

[10] http://www.plos.org/publications/

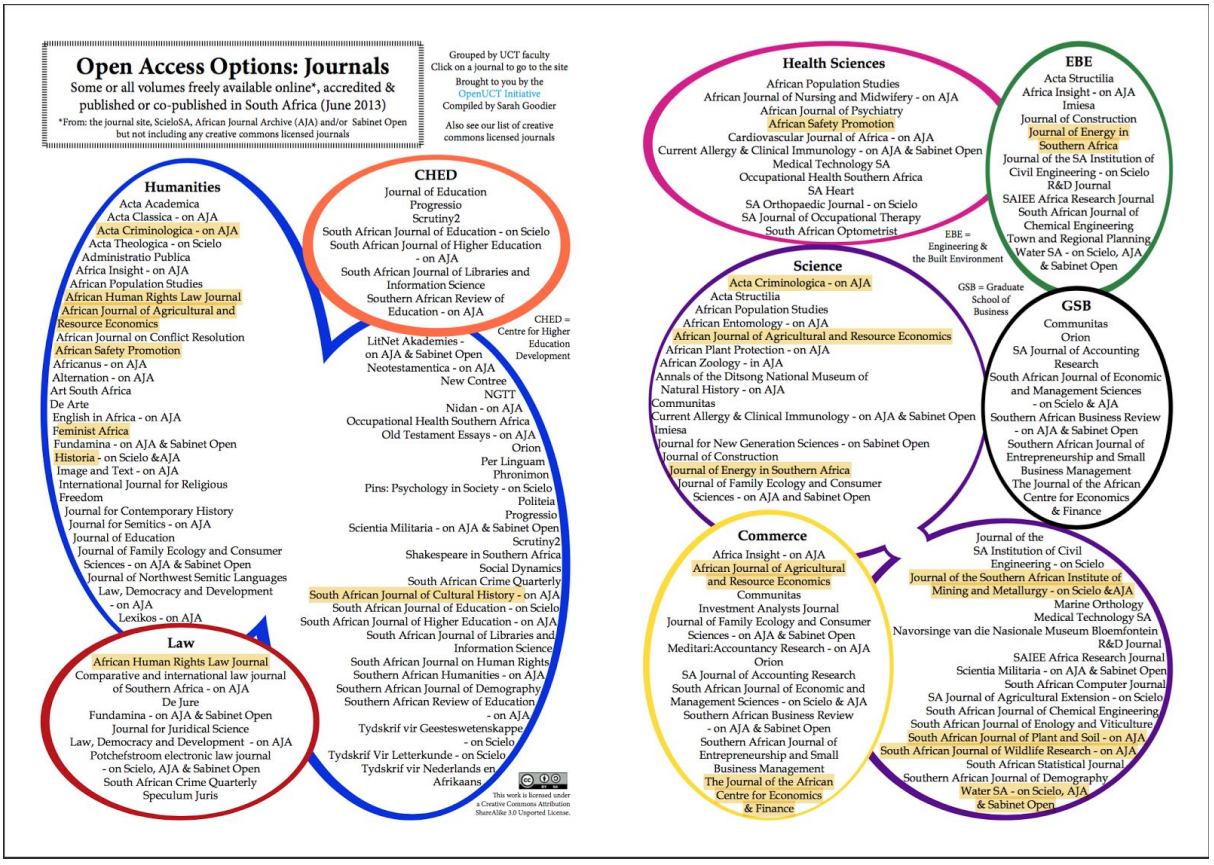


Figure 6: map of Open Access Options: Journal produced in the frame of the OpenUCT Initiative and compiled by Sarah Goodier (2013) that list the creative commons licensed, 2013 accredited journals that are published or co-published in South Africa. In yellow are highlighted the journals contacted. Source : http://bit.ly/2tV04HZ

From this map 12 peer-reviewed South African journals were identified and contacted on the basis of their pertinence with the topics included in our list of articles to review. Moreover, two international journals (from Canada and UK), one of which had copyright restrictions, were also selected to evaluate any differences and compare results. In total, 14 journals were contacted to review a total of 52 Wikipedia articles.

Different to the first phase, editors in chiefs were approached through a "Call for scientific journals to share bibliography on Wikipedia"[11]. They were introduced on the project, and then specifically invited to contribute to it by identifying, suggesting, and sharing their published bibliographic references relevant to the list of articles provided. The number of articles proposed to each journal was reduced (from two to five articles for each journal) in order to minimize the effort required through their engagement. Editors had been informed that their bibliographic contributions would allow other researchers and Wikipedia editors to know exactly where to find primary sources to improve the articles and that, at the same time, they would gain visibility and improve reputation in term of contribution to knowledge –journal attribution is always cited and Wikipedia has 500 million readers in over 280 linguistic editions, in addition to free mobile phone access in around 30 countries, and offline distribution.

Request for a preliminary Wikipedia community of the article

[11] Template of a letter sent to a scientific journal: https://docs.google.com/document/d/160ed-6f5yDe9_0J17-5XaRPWDpLbV-teRXLWJVUHRUA/edit?usp=sharing

After an expert confirmed his/her interest in reviewing an article, the notification of his/her involvement was published on the talk page of the article in question. The notification included the name of the expert, the affiliation, and a link to their personal page. Once a reviewer was assigned an article, the Wikipedia community was given two weeks to do final edits and additions before the article was sent in its "final" state to the reviewer.

Retrieval of the article to the expert along with a feedback form
Once the two weeks for the Wikipedia community's preliminary review expired, a pdf version of the article and specific guidelines for the review[12] were sent to the reviewer. The guidelines included a set of questions concerning: a) The quality of the summary; b) The structure and style of the article; c) The content; d) The international and local dimensions; and e) The references.

Collection of the expert review
Reviewers were given one month to complete their review, although requests for deadline flexibility was always granted. After six months of inactivity the review was considered to be "withdrawn".

Publishing the expert reviews

Uploading expert reviews on Wikimedia Commons
Experts' reviews were all uploaded (published) on Wikimedia Commons[13] in pdf format. The reviews mentioned on the relevant Wikipedia article's talk page, with a thumbnail view of the pdf, and a direct link to the review on Commons.

For some articles, individual participants (known to be interested in the topic, or a prior participant to the article) and specialised discussion venues (project pages or forums) on Wikipedia were informed that the review had been published.

Copying and pasting the expert reviews on the talk page of the related article

The review process was altered for the last six reviews published from February 2016 onwards. The first reviews were published only in the form of a pdf document mentioned in the article talk page. This system did not seem very enticing for community members who are more used to reading comments and suggestions as text on a wiki page. As a consequence, the process was altered so that the expert comments were directly copied onto the article talk page, thus potentially facilitating their reuse.

Outcomes measured were:

- whether the published review brought any comments from the community
- whether the published review actually led to any improvement to articles

Request to OTRS to record authorship and licence
OTRS[14] (Open Source Ticket Request System) software has been used since September 2004 to handle queries, complaints, statements, and comments from the public by email to Wikimedia projects. Wikimedians want confirmation that the copyright holder of images or text provided on Wikipedia or Wikimedia Commons has agreed to the license (CC-BY-SA) used by the project. This is

[12] Model of review guidelines sent to reviewers available here :
https://docs.google.com/document/d/1qaObfuLq4Vniz7sfKPyzn3RXExIz9nbpbJi9VEyA6hA/edit?usp=sharing
[13] All expert reviews may be found here :
https://commons.wikimedia.org/wiki/Category:Wikipedia_Primary_School_SSAJRP_reviews
[14] OTRS: Open Source Ticket Request System. More information about OTRS in the Terminology section at the end of this report

traditionally done by asking the copyright holder to send a licence release confirmation by email, whose record is then stored within the OTRS system.

Accordingly, each expert review published on Wikimedia Commons, as well as all the new versions of any article re-written by an expert on Wikipedia, was the object of OTRS permission procedures.

After uploading the review or the next text, a template email stating the authorship and license information of the content was sent to the expert. The expert was asked to send this email himself/herself to the OTRS permission system for archival purposes. OTRS agents acknowledge receipt of the appropriate documentation to confirm authorship and licence of the document. The existence of the record was then mentioned on the article talk page by the OTRS agent.

Full article rewriting by an expert

Copy editing of the article on Wikipedia
Experts were always asked to review a specific existing article. In some cases, however, experts decided to either:

- propose an entirely new text, sent as an attached document by email,
- or directly edit the online wikipedia article themselves.

In the case of articles rewritten directly on Wikipedia by experts, a review and light copy editing of the article was done to finetune their work.

In the case of articles proposed in a document, the new article or the new version was first copy-pasted into Wikipedia "as is" and authorship of that version attributed in the comment box or on the discussion page of the article. The article was then reviewed and copyedited according to expert suggestions, but consistently within Wikipedia's rules and guidelines. If relevant, additional content (such as images), clarification of facts, or additional sources were sought from the expert.

Request to OTRS (Open-source Ticket Request System) to record authorship and licence
In addition to the copy-editing provided on the article rewritten by the expert, we recorded authorship and licence information through the above mentioned OTRS system.

Request for assessment or reassessment of an article by Wikipedia community

The editor community occasionally organises itself into *WikiProjects* (WP). A WikiProject is an initiative by a group of contributors who want to work together as a team to improve Wikipedia. These groups focus on a specific topic area, a specific location or a specific kind of task. The English Wikipedia currently has over 2,400 WikiProjects, each with varying levels of activity.

A 'typical' WikiProject contains a few participants that monitor and maintain a project communication hub that supports a wide variety of work activities of a number (sometimes large, sometimes small) of peripheral participants. The actions of each project is largely self-assigned (sometimes community driven) and pursued independently, sometimes with more intensive collaborations organised through other channels (Morgan et *al*. 2013).

Most WikiProjects participants select articles that belong to their area of activity, and evaluate the articles. Evaluation is considered both in terms of article quality, and in terms of article importance with regards to the Wiki Project focus.

Quality assessment is done using a grading scale:

- *Stub*: A very basic description of the topic. However, all very bad-quality articles will fall into this category.
- *Start:* An article that is developing, but which is quite incomplete. It might or might not cite adequate reliable sources.
- *C*: The article is substantial, but is still missing important content or contains much irrelevant material. The article will have some references to reliable sources, but may still have significant problems or require substantial cleanup.
- *B*: The article is mostly complete and without major problems, but requires some further work to reach good article standards.
- *GA:* The article has attained good article status by passing an official review.
- *A*: The article is well organised and essentially complete, having been reviewed by impartial reviewers from this WikiProject or elsewhere. Good article status is not a requirement for A-Class.
- *FA*: The article has attained featured article status by passing an official review.

Assessments are done on a voluntary basis. Lower grades are usually given by a single individual without specific discussions, whilst higher grades are given only after a more thorough review of the article by several individuals. Grades may be challenged over time (as the quality of the project increase, so do the requirements to be a featured article for example). It is possible for an article to be part of several WPs or of none. Grades are displayed on the article talk page.

Given that it is possible to request an assessment in a WikiProject discussion page and that the request is likely to bring attention to an article, the hypothesis was that such a request could result in the page being further edited and improved.

Accordingly, the methodology developed the following processes:

Review and record each article assessment on the different WikiProjects it belongs to / Compare and evaluate all assessments
We reviewed all articles in our dataset and recorded whether they belonged to none, or to one, or to several WikiProjects. When they belonged to one or several WikiProjects, we noted if there were significant differences between assessments when several were available, and evaluated whether the assessments provided were legitimate or outdated (taking into account the discrepancy between the grade mentioned and the current state of the article).

Identification and selection of articles to ask for (re)assessment
We established a short list of all articles where a gap or missing information was noted. In this list, we selected articles to request re-assessment, and the implementation of related actions required for this re-assessment. For articles not referenced by any WikiProject, a relevant WikiProjects was identified and asked to assess the article.

Case description	Requested actions	N. of articles identified	N. of articles selected
Case 1. An article belongs to several WikiProjects, but quality grades given by projects differ significantly	Reassessment by several WikiProjects	7	5
Case 2. An article belongs to one or several WikiProjects but has never been assessed	Assessment by a WikiProject for the first time	8	5
Case 3. The original assessment of an article is outdated	Reassessment by the WikiProject it belongs to	3	2
Case 4. An article does not belong to any WikiProject	Identification of a relevant WikiProject that might adopt it and assess it	7	2

Table 4: summary of the implementation of the methodology "Request for assessment or reassessment of an article by Wikipedia community"

Implementation of actions for re-assessment.
Requests for assessing, reassessing or adopting an article were made in the talk page of relevant WikiProjects, in the section dedicated to that purpose.

Outcome was measured after 4 weeks and after 7 weeks. Three different types of outcomes were identified:

1. Feedback from community to the request (such as a comment left on the talk page);
2. Whether a new assessment of the article was done; and
3. Whether the article was significantly modified in the weeks following the request.

Call for new article creation

Proposing articles to the Wikiproject "Requested Articles"
One of the WikiProjects of the Wikipedia community is specifically meant to deal with "Requested Articles". Placing a request on this WikiProject raises attention to editors about articles do not exist and should be created, with the associated trigger of fulfilling the wish of a fellow community member. One hypothesis was that listing some of the topics identified during the analysis phase that had no equivalent article on Wikipedia on the Requested Articles WikiProjects would result in the creation of new articles. As a consequence, several articles were proposed to this WikiProject over the course of the project.

Triggering production of content on Wikipedia > Articles featured on Portal pages

Selection of portal pages
Wikipedia portals are pages intended to serve as "Main Pages" for specific topics or areas. A portal may be associated with one or more WikiProjects, but unlike a WikiProject, it is meant for both readers and editors of Wikipedia, and should promote content and encourage contribution. Portals are created for encyclopedic topics only. The idea of a portal is to help readers and/or editors navigate their way through Wikipedia topic areas through pages similar to the Main Page. In essence, portals are useful subject-specific entry-points to Wikipedia content.

Accordingly, the hypothesis was made that featuring some articles in portal pages could lead to further consultation and modifications of those articles. For the purpose of the research, the English Wikipedia South Africa portal page[15] was selected.

Selection of articles to add on portal pages / addition
The South Africa portal page features, amongst other content, a section for selected articles, a section for selected quotes and a section for selected biographies. The content displayed is randomly chosen in the selected list. Three articles, as well as one biography with associated quotes, were chosen to be displayed. Three months later, the articles were studied to explore:

1. whether they had received significant attention from editors (whether for improvement or in terms of vandalism); and
2. whether the articles were consulted more (i.e. an increase of daily page views, using the automatic page view tool: https://tools.wmflabs.org/pageviews/#).

Call for participation to online writing contests

Suggestions for articles' creation in two writing contests

On the occasion of the 15 year anniversary of Wikipedia (15 January 2016) the online "Wiki Loves Women" writing contest[16] took place. The goal of the contest was to create at least 15 new biographies of African Women within 15 days. The articles were created by self-organized teams in French or English. A list of missing biographies was provided to participants but teams were free to cover any missing biographies they wished. Additionally, a list of articles that exist in a language other than the target language was provided. Awards were attributed to teams, according to the quality and quantity of the content provided, and consisted in official recognition ("barnstar").
As part of the Primary School project, 29 names of biographies of South African notable women were suggested for creation to the participants.

In October and November 2016, another online contest was organised, the Africa Destubathon[17]. The goal of this contest was to reduce the number of very short articles (stubs) available on Wikipedia about Africa (over 37 000 articles were suggested). Volunteers were invited to expand and improve at least 2000 such articles over 6 weeks. Participation was proposed at the individual level. Awards were distributed to individuals, based on the number of articles improved within a certain geography (country level) or within certain thematic areas. Awards were officially recognised ("barnstar"), as well as financially rewarded (with Amazon vouchers distributed to winners as prizes). The contest was well attended and successful with 2717 articles improved (676 relating to women). At the end of the contest, 18 people were eligible for a monetary price, the highest individual gift being 445 US dollars.

Whilst most articles improved were only worth 1 point in the challenge, some articles would provide double score, or triple score or even quintuple score. Seven very short articles in the Wikipedia

[15] https://en.wikipedia.org/wiki/Portal:South_Africa
[16] https://en.wikipedia.org/wiki/Wikipedia:Wiki_Loves_Women/Writing_Contest.
Wiki Loves Women Writing Contest logo. Cc by sa 4.0. Design Isla Haddow-Flood based on Wikipedia 15 logos. https://commons.wikimedia.org/wiki/File:WLW_Nefertiti_wordmark2.png
[17] https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Africa/The_Africa_Destubathon.
Logo for the Africa DeStubathon based using the file Africa continent file by Outstandy created for Wikipedia 15. cc by sa 4.0. Design by Isla Haddow-Flood. https://commons.wikimedia.org/wiki/File:Africa_DeSTUBathon_04.jpg

Primary School dataset were listed as suggestions to editors. They would provide a double score at the country level and required only simple improvement to receive the bonus. Four well-developed articles in the dataset were also listed as quintuple score in the general bonus page and would require the article to reach a much higher quality ("Good Quality") level for the editor to get the bonus.

Edit-a-thons organised by University of Cape Town in South Africa

Identification of dates and venue

In the online communities of projects such as Wikipedia, an *edit-a-thon* is an event where editors get together to edit and improve a specific topic or type of content, typically including basic editing training for new editors. The word is a portmanteau of "edit" and "marathon".

Three edit-a-thons were organised in Cape Town in collaboration with the Wikimedia South Africa Chapter. These took place on the 5 December 2015, 19 February 2016 and 26 February 2016.

Identification of articles to be created or improved

Nine topics were identified prior to the edit-a-thons. The topics suggested to be covered during the edit-a-thons were all South-Africa related topics. All of them were either missing articles, or had articles in need of extensive rewriting and expansion. They were generally focused topics, rather than global in nature.

Figure 7: example of invitation sent for the first edit-a-thon in Cape Town. CC-BY-SA 4.0. Author: Theresa Hume.

Organisation, communication and advertisement

During the first event there was little local advertising or partnerships with local organizations. For the second and third workshop a list of guests was invited to the event and the communication and advertisement process were widely distributed.

The process followed in South Africa to organise the edit-a-thons included:

1. Identifying dates and suitable venues for the edit-a-thons. Wi-Fi access and in-kind contribution for the venue were the main criteria of selection;
2. Identifying suitable content on which the participants would work;
3. Organising caterers for each event;
4. Communicating and advertising via various mediums;
5. Creating event pages on Wikipedia in order to describe the objective of the events, track attendance, and mention the suggested articles to be addressed.

The second and third event were communicated and advertised through social media (Facebook, Twitter), websites (Wiki Loves Women, Wikimedia ZA, Joburgpedia, Wiki Loves Monuments, Wiki from Above, UCT IP Unit), university mailing list, radio and tv stations, printed press, various wiki meta pages, mailshots to local educational institutions (Historical Studies at UCT, African Gender

Institute at UCT, Archeology at UCT, Centre for Higher Education, Library Association of South Africa), Wikipedia Geonotice for South Africa, university partners, and an event page on Eventbrite.

Edit-a-thons organised by other parties

Track planned meet-ups
Regular (or more spontaneous) face-to-face meetings of Wikipedians take place in cities around the world. The "Wikipedia:Meetup page"[18] is used as a starting point for Wikipedians organising meetups (this page is primarily used to list meetings organized with English used as the primary language), and subpages are used for finalising the details once a meetup has been agreed. During the course of the research, the Meetup page was monitored to identify potentially relevant events during which the dataset could be proposed.

Wikimedia chapters and UserGroup generally have a website where incoming events are announced to the public. Accordingly, the New-York, Washington, UK and South Africa publications were followed to identify relevant meetups.

Contacting the organisers of planned events
Several groups were contacted directly, by emails or on their Wikipedia user talk page.

Meetups may feature a variety of activities: training new editors, writing articles on a specific theme, workshops, photo hunts, informal get togethers, etc. Many of those meet-ups are actually part of the regular activities of Wikimedia chapters or Wikimedia UserGroups. The most active groups (when it comes to face-to-face activity) are related to Washington, New York and UK groups. Some of the groups meeting face-to-face on a regular basis are also Tasks Forces on Wikipedia and collaborate to get specific things done. An example is the AfroCrowd, an initiative that seeks to increase the number of people of African Descent who actively partake in the Wikimedia and free knowledge, culture and software movements. AfroCrowd regularly meet in New York City (USA). Groups such as AfroCrowd typically maintain lists of articles to create or improve.

The hypothesis was that it might be possible to get some of our targeted articles improved by:
- getting in touch with organisers of events and suggesting a theme for one of their future edit-a-thons (which could lead to the improvement of several of our targeted articles),
- adding some of the targeted articles to their lists or
- joining an already planned edit-a-thon on a topic consistent with some of the targeted articles.

The process followed was to:
- regularly track planned meetups on https://en.wikipedia.org/wiki/Wikipedia:Meetup;
- contact organisers of events listed on meetups when the topic was relevant to some of the targeted articles;
- explore which active groups regularly organise face-to-face or online activities and to then contact their leaders to introduce them to Wikipedia Primary School Programme and seek help in improving articles; and
- add targeted, relevant articles to the task force's lists.

Three groups were contacted, AfroCROWD in New York City, Wikimedia UK in London and Wikimedia Washington.

Add targeted relevant articles to task forces' lists

[18] https://en.wikipedia.org/wiki/Wikipedia:Meetup

Per suggestion of the AfroCROWD leaders, six articles were added to the AfroCROWD task list on the 5th of July 2016. Those were to be edited either online, or during some of the edit-a-thons organised by AfroCrowd.

Some articles were proposed to an edit-a-thon *Occupational Safety and Health* organised by Washington DC. A meet-up was proposed by WikiProject Occupational Safety and Health : Wikipedia:Meetup/DC/Safe and Healthy at Work (July 15th 2016). Three articles were added to the suggestion list for the WikiProject and the meetup, suggesting the related activities for improvement.

3.3. Set up of a Wikipedia tracking and assessment system

The Wikipedia community created a system to assess articles belonging to a WikiProject[19]. Wikipedia Primary School SSAJRP is a sub section of the WikiProject South Africa.

One of the most common methods used by WikiProjects to monitor and prioritise their work is that of assessing the articles within their scope. A very small or less-active project can keep a hand-compiled table of assessments; as the number of articles increases, however, a specialised process becomes necessary and requires a more sophisticated approach: bot-assisted assessments. The bot-assisted assessment scheme works by embedding assessments in the banner on the WikiProject's talk page. Practically speaking, it requires the creation of a specific WikiProject banner and the addition of this new banner to the discussion page of each article that the WikiProject wants to assess[20].

The assessment may be done on two variables. The first is "Quality", the second is "Importance". Each article may be tagged with a range of options to describe its overall quality (as per Wikipedia criteria): stub, start, C, B, GA, A, and FA. "Stub" typically describes an article providing a "very basic description of the topic. However, all very-bad-quality articles will fall into this category". An "FA" (featured article) is described as "professional, outstanding, and thorough; a definitive source for encyclopaedic information". "Importance" may be estimated as well, but is to be considered as being the "importance of the topic from the point of view of the WikiProject".

Once articles are tagged according to their quality and their importance, a summary of information may be automatically produce by an automated system. The assessment system will provide an instant view of the overall state of the articles included in the WikiProject, but can also provide further information, such as the changes to their "quality" and "importance" parameters over time, that indicate the top most edited articles within a WikiProject over a period (typically a week), etc..

Hypothesis was made that setting up an assessment system could bring attention to articles, thus resulting in further consultation and modifications of those articles. This could happen:

- once the setup of the general assessment system is complete (it requires the creation of several pages to operate, a call for help when troubleshooting is required, and attention for the WikiProject when registering to a bot service);
- once the talk page of each article in question is tagged with the WikiProject banner.

The expectation over the long term, is that once the assessment pages are up and working, new global information on the topic would be forthcoming.

[19] Additional information about what a WikiProject is in the “Terminology” section at the end of this report.

[20] See such an example here : [[Talk:Constitution Hill, Johannesburg]]

The process included:

- studying and understanding the operational setup of a WikiProject Assessment and of all reporting systems involved;
- creating all generic assessment sub pages and templates for the Primary School Project;
- adding banners to all targeted article talk pages and removing previous categories to avoid cluttering the space;
- registering with a bot service and following-up with the bot operators;
- fine-tuning a selection of bot services.

3.4. The Wikipedia Scientific Journal

Figure 8 : Issue Zero of the Wikipedia Scientific Journal. Presentation of the graphic design and pilot issue with an example article (an existing reviewed article by Ploss). CC-BY-SA 4.0 Graphic design by Giancarlo Gianocca.[21]

The Wikipedia Scientific Journal is a peer-reviewed scientific publication designed to collect and assess content for Wikipedia. The "Wikipedia Scientific Journal" is open access, under Creative Commons attributions share-alike license. Its content can be used, reused and modified by anyone for free for commercial and non-commercial purposes. Its purpose is a tool to be used to enrich the content of Wikipedia.

The journal produces thematic issues launched with calls for papers. Anyone can submit articles; also existing Wikipedia articles can be submitted for peer-review. The peer-reviewers are scholars with academic affiliation; they are involved through partnerships with existing scientific journals. The journal has the format of a traditional academic journal. It credits authors, Wikipedia authors (if pertinent) and the partner scientific journals. An open and editable edition of the journal is also provided on Wikisource.

The "Wikipedia Scientific Journal" aims at:

1. Addressing scholars and engaging them in contributing to Wikipedia.
2. Peer-reviewing new and existing Wikipedia articles with peer-reviewers with an academic affiliation and in collaboration with existing academic journals.
3. Producing calls for papers for specific thematic issues.
4. Publishing the articles on a traditional online journal under Creative Commons attribution share alike license.
5. Attributing the articles to the authors and to the existing academic journal which is partnering with "Wikipedia Scientific Journal" for the peer-review process.

[21] *Source :* https://commons.wikimedia.org/wiki/File:140610_Wikipedia_Scientist_Journal_-_Issue_Zero.pdf

6. Assessing high quality articles which can be used on Wikipedia and translated.

The “Wikipedia Scientific Journal” is conceived as a tool to allow the project to produce and assess Wikipedia articles related to primary education.

In August 2014 the first experiment of the Wikipedia Scientific Journal was done. The issues 0 was drafted and the graphic design defined by Giancarlo Gianocca. This pilot issue aimed at presenting the journal to potential authors, reviewers and journals and it presented content retrieved from PLOS ONE, in order to show an example of academic article released according to Wikipedia rules and peer reviewed by a scientific journal with an impact factor of 4411 in 2015.

4. Impact of the different strategies tested to trigger contributions

Nine different strategies were conceptualised and tested. The strategies were aimed at triggering contributions and engagement with the material by academics, experts and wikipedians. As a result of the different cultures and traditional means of engagement within these groups, many varied approaches were required.

Strategies	**Number of articles**	**Results**
Review of content by journals	94[22] requests sent to journals to review articles or to share relevant bibliography	2 negative replies 2 positive replies, then withdrawn 0 articles reviewed
Review of content by experts	115[23] requests to review sent	26 articles reviewed / 5 articles rewritten
Publishing of the expert review	19 expert reviews published on Wikipedia	18 articles improved
Request for assessment or reassessment of an article by Wikipedia community	14 articles requests for (re)assessment 3 requests for adoption by a WikiProject	2 articles (re)assessed 0 articles "adopted" by a WikiProject 0 articles improved
Call for new article creation	4 articles requested	2 new articles created
Articles featured on Wikipedia Portal pages	4 articles posted on page portals	1 article improved 3 articles viewed
Call for participation in online writing contests	29 articles suggested for the writing contest 11 articles proposed during the "destubathon"	7 new articles created (translations) 8 articles highly improved
Edit-a-thons organised by the team in South Africa	26 articles suggested for improvement or creation	8 articles improved (minor edits)
Edit-a-thons organised by other parties	9 articles proposed	0 articles improved

Table 5: overview of the different strategies tests, their implementation, and the associated outcome on Wikipedia.[24]

[22] This figure doesn't include double requests
[23] This figure doesn't include double requests
[24] Methodologies applied to each article.
Download the full document: https://commons.wikimedia.org/wiki/File:LifeTime_of_a_Primary_School_Article.pdf
Access working document:
https://docs.google.com/spreadsheets/d/1lFfeKmthE0PMuMiOZMqEve6uKaU5DiY0juw0td5XvWA/edit#gid=838484359

4.1. Tracking with the assessment system

Access to the Wikipedia Primary School assessment system [25]
The process to set the assessment system was quite time-consuming and likely to be too complicated for a new participant to Wikipedia. The setup of the assessment raised attention in particular due to:

- the fact "Primary School Project" was originally set up as a sub-section of the WikiProject South Africa rather than set up as a WikiProject on its own. The visual implication is that the Primary School Project page is primarily tagged as "WikiProject South Africa" rather than clearly tagged as Primary School Project. Accordingly, some editors rejected the addition of the banner to the talk page of some articles, arguing that the article was unrelated to South Africa and consequently should not be tagged as such (examples of this situation are Outer space[26], or Settling[27], both of which are not clearly related to South Africa). This situation still occurs from time to time. Fortuitously, the bot system detects unwanted banner removal, so this can be monitored. Restoring the tag sometimes requested quite a bit of explanation. This suggests that set-up of projects as a sub-section of a larger WikiProject, should be considered carefully and generally avoided due to the confusions it creates.

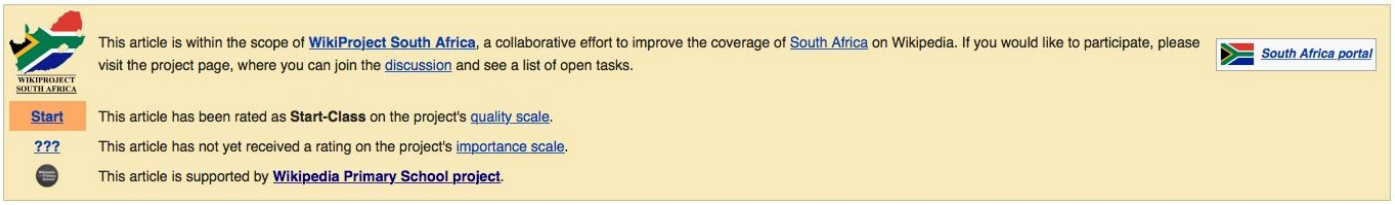


Figure 9 : screenshot of the Primary School Project mention in the talk page of the article: settling

- Another issue encountered was related to the original category set up to "tag" articles belonging to the Primary School Project, which was considered "not obvious" (it included "SSAJRP"). The category was consequently put up for deletion. Consensus was found to rename the category into a more obvious one [[category:Wikipedia Primary School articles]][28] .
- A third issue related to the fact that the above mentioned category, whose unique goal is to facilitate the maintenance of the content, had at first been placed directly in the article itself, rather than on the article talk space, thus disrupting the community's agreed practice.

The discussions around these issues were not always very friendly, but ultimately consensus was found and a volunteer editor helped fix the categories.

[25] https://en.wikipedia.org/wiki/Wikipedia:WikiProject_South_Africa/Wikipedia_Primary_School/Assessment
[26] https://en.wikipedia.org/wiki/Outer_space
[27] https://en.wikipedia.org/wiki/Settling
[28] https://en.wikipedia.org/wiki/Category:Wikipedia_Primary_School_articles

1 Statistics [edit source]

PSP SA articles by quality and importance			
Quality	Importance NA	???	Total
FA		1	1
GA		9	9
B		37	37
C		76	76
Start	1	50	51
Stub		4	4
List		1	1
Assessed	1	178	179
Total	1	178	179
WikiWork factors (?)		ω = 707	Ω = 3.99

Figure 10: Dashboard of all Wikipedia Primary articles tracked, by importance and quality.

2 Hot [edit source]

- 11 edits Kingdom of Mapungubwe
- 10 edits Wetland
- 9 edits Apartheid
- 8 edits Wood
- 8 edits Child abuse
- 7 edits Saartjie Baartman
- 7 edits Ecosystem
- 7 edits Mahatma Gandhi
- 6 edits HIV/AIDS
- 5 edits Domestic violence

Figure 11: Automatic display of the 10 most edited articles in the past 7 days.

3 Alerts [edit source]

Redirects for discussion

- 20 Feb 2017 – 4664 (talk · edit · hist) →Nelson Mandela was RfDed by 208.95.51.115 (t · c); see discussion
- 20 Feb 2017 – Verdurous (talk · edit · hist) →Health was RfDed by Tazerdadog (t · c); see discussion

Good article nominees

- 29 Oct 2016 – Day of Reconciliation (talk · edit · hist) was GA nominated by Wasabi,the,one (t · c); start discussion

Requested moves

- 21 Feb 2017 – **Saartjie Baartman** (talk · edit · hist) is requested to be moved by Dodger67 (t · c); see discussion

Figure 12: Alerts generated by the system about the Wikipedia Primary articles

4.17 September 8, 2016 [edit source]

4.17.1 Reassessed [edit source]

- **Constitution Hill, Johannesburg** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).
- **Convenience food** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).
- **Gender role** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).
- **Heritage Day (South Africa)** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).
- **Map** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).
- **Mapungubwe Collection** (talk) reassessed. Quality rating changed from **Stub-Class** to **B-Class** (rev · t).
- **Nest** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).
- **!Kung people** (talk) reassessed. Quality rating changed from **Start-Class** to **C-Class** (rev · t).

4.18 August 24, 2016 [edit source]

4.18.1 Assessed [edit source]

- **Outer space** (talk) assessed. Quality assessed as **GA-Class** (rev · t). Importance assessed as **Unknown-Class** (rev · t).

4.19 August 22, 2016 [edit source]

4.19.1 Removed [edit source]

- **Outer space** (talk) removed. Quality rating was **GA-Class** (rev · t). Importance rating was **Unknown-Class** (rev · t).

4.20 July 22, 2016 [edit source]

4.20.1 Assessed [edit source]

- **Bias** (talk) assessed. Quality assessed as **Unassessed-Class** (rev · t). Importance assessed as **Unknown-Class** (rev · t).

4.21 July 21, 2016 [edit source]

4.21.1 Assessed [edit source]

- **AIDS orphan** (talk) assessed. Quality assessed as **Stub-Class** (rev · t). Importance assessed as **Unknown-Class** (rev · t).
- **Acid** (talk) assessed. Quality assessed as **C-Class** (rev · t). Importance assessed as **Unknown-Class** (rev · t).
- **Africa Day** (talk) assessed. Quality assessed as **Stub-Class** (rev · t). Importance assessed as **Unknown-Class** (rev · t).
- **Alcohol abuse** (talk) assessed. Quality assessed as **C-Class** (rev · t). Importance assessed as **Unknown-Class** (rev · t).

Figure 13: Log of the assessments and reassessments of the Wikipedia Primary Articles over time

Results when it comes to triggering production
Whilst the assessment system allows to track both "quality" and "importance", only quality was assessed (as it was determined that all articles had the same importance within the Primary School Project). The system provided information that helped to track activity on articles and is a useful tool to do group work on articles. However, there is no evidence that it actually impacted editorial activity.

4.2. Review of content by scientific journals

25 scientific journals were contacted in total.

Out of the 11 journals contacted in December 2015, only two answered the call for review, and after more than two months from the initial invitation. Both of them declined the invitation. Their reasoning was:

1. The organisation's inability to share the contact detail of reviewers: "*Although we appreciate efforts to disseminate quality information, we cannot pass on the details of reviewers to outside people or companies, as the reviewers have not consented for their personal information to be shared in this way*". (10 February 2016)
2. The lack of interest to contribute to Wikipedia due to its lack of scientific and academic approach: "*We are not interested in contributing to Wikipedia with its superficial coverage of topics and unacademic analysis of research findings let alone evidence-based.* (17 March 2016).

During the second phase (May 2016), 14 journal editors were contacted. Out of 14 journal editors contacted, two of them answered positively – reporting their interest in contributing by sharing bibliographic reference for a total of nine articles, despite the practical difficulties. Difficulties, which ultimately prevented their answers and activities, include:

1. Time issues. The first journal postponed its collaboration to September 2016. After two reminders in September and October 2016, we consider it withdrawn.
2. Partnership/cooperation model. The journal requested better specifications on how we would collaborated. The answer specified the process of involvement and any related tasks. Once the SUPSI research team received their list of bibliographic references for each article, they would have:
    a) Added the name of the journal to the meta page dedicated to the Wikipedia Primary School project, under the section "journal partners";
    b) Updated the bibliographic reference provided directly on the article main page; and
    c) Reported the name of the journal on the talk page of the articles they contributed to. However, no further feedback was received from the journal.

4.3. Contributions by the academic experts

We contacted 136 academic experts[29] to review 115 articles (some articles being proposed several times), with the following results:

- 32 experts confirmed their availability to review 47 different articles (one article was reviewed twice).

[29] The full list of academic experts contacted may be found here :
https://docs.google.com/spreadsheets/d/1ZYeygCQTFX6wycDUtV_vIx4ET_IMo02_qDPJhF61rFY/edit#gid=888032418

- 21 experts submitted their reviews for a total of 31 articles.
- Out of the 31 reviews received, in 26 cases the review by the expert was made after a community review. In five cases, the expert review was made with no prior community review.
- one article was directly improved online by the expert.
- five rewriting propositions for four articles were proposed by the experts by document.
- two propositions were implemented.
- 11 experts withdrew their commitment to 18 articles.

Only 15,4% of academic experts contacted actually did the review. The 8.1%, corresponding to 11 experts initially accepted to review the articles and then withdraw their commitment. When they stopped replying after two solicitations they were considered to have withdrawn. When they specifically reported their withdrawal, the reasons included their lack of time to do the review, but in those case they usually suggested and referenced new potential reviewers to contact.

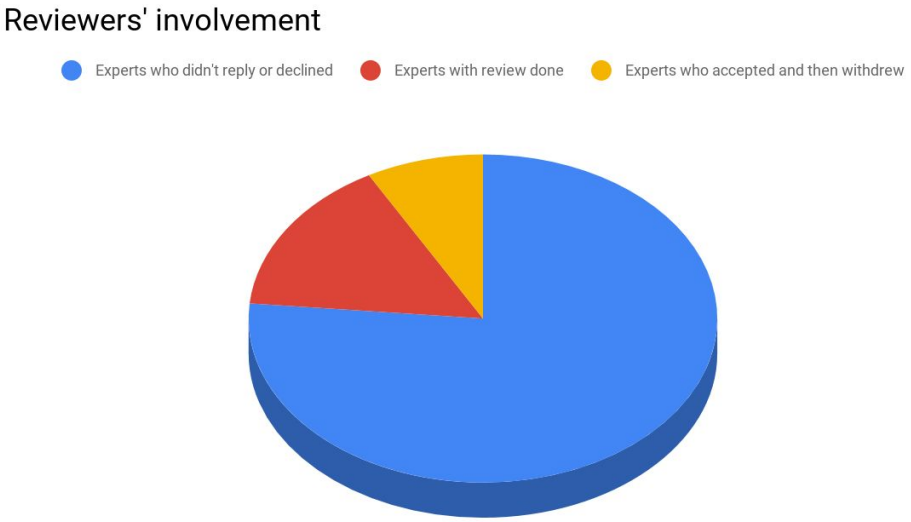


Figure 14: 136 academic experts were contacted and asked to review 115 Wikipedia articles (some articles being proposed several times).

Expert reviewers who actually submitted the reviews came mostly from South Africa (n. 8), followed by The Netherlands (n. 3) and United States (n. 3), Switzerland (n. 2), Italy (n. 2), Swaziland (n. 1), Mozambique (n. 1), Australia (n. 1), and the United-Kingdom (n. 1).

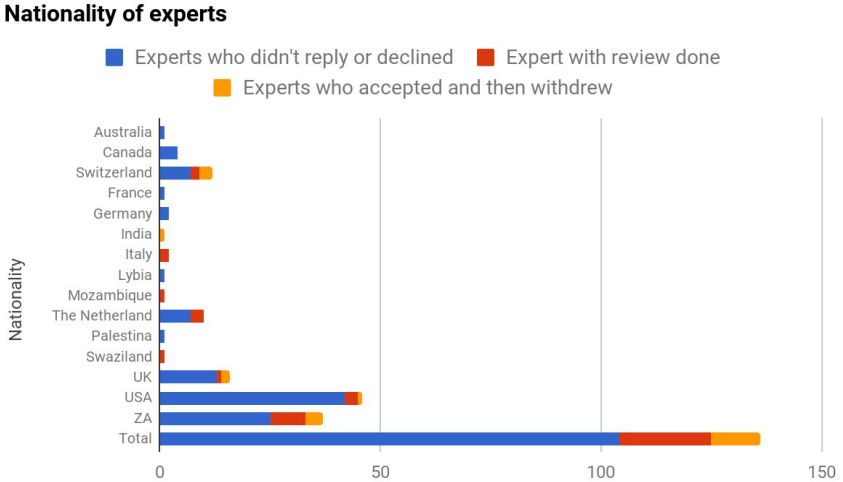


Figure 15: Nationality of academic experts contacted to review Wikipedia Primary School Project articles.

The most effective strategies to reach academic experts (see Table 6 below) were those that involved direct references and suggestions from other scholars were provided. It had an impact of 41,18% on the expert's acceptance. All other strategies tested to involve academic experts had an effectiveness of around 10%.

	Number of experts contacted	**Experts with review done**	**Experts who accepted and then withdraw**	**Experts who didn't reply or declined**
Online desk research	**97**	12 reviews 12%	8 reviews 8%	77 reviews 79%
Conference on African studies	**11**	1 review 9%	1 review 9%	9 reviews 81%
African study centres	**11**	1 review 9%	1 review 9%	9 reviews 81%
Direct reference from scholars	**17**	7 reviews 41%	1 review 5%	9 reviews 52%
Total	**136**	**21**	**11**	**104**

Table 6: Outcome of strategies implemented which led academic experts to review Wikipedia articles.

It has been noticed that the involvement of the experts relied heavily on when the requests were forwarded. A greater number of experts agreed to help at the beginning of the academic semester (February – March and September – October) rather than at the end (we receive just one reply for a call sent in December and none from those sent in July).

In 75% of cases, the articles reviewed were strictly related to South African topics; in particular South African history, cultural heritage and health conditions. Only seven reviews concerned generic articles that included a primary school educational interest beyond South Africa. Those generic articles were the Wikipedia entries: Bicycle, Gender role, Hand washing, Water pollution, HIV, Health, and Ecosystem.

4.4. Publishing the expert review

Thirty one reviews were uploaded on Wikimedia Commons and then referenced on the talk page of the related article. A new strategy was implemented in the second half of the project, and consisted of pasting the text of the reviews directly on the talk page rather than simply linking to the review in pdf format. This new strategy did not have any significant impact compared to simply linking to the review in pdf format. The editorial activity on the articles was checked in February 2016 and then again in October 2016. Any modifications that had been implemented were compared to the suggestions from each expert's review so as to evaluate cases where improvements had been triggered by the review.

The impact of expert reviews was :

- eight articles had been improved, with clear use of the expert review;

- five articles had been seriously improved, but with no community comment added in the talk page and no explicit use of the expert review;
- one article had received minor improvements, but the Wikipedia Primary School team was further contacted by a group of wikipedians who were setting-up an external expert review by a medical journal and they reported that they were interested in future collaborations;
- four articles saw minor improvements, with or without community feedback about the review;
- nine articles had not been improved.

4.5. Request for assessment or reassessment of an article by Wikipedia community

Table 7 below reports the results measured from the request for assessment and reassessment of articles within WikiProjects in terms of new assessment made, feedback from the community and article changes:

Case description	Implementation	Reassessment	Feedback	Articles improved
An article belongs to several WP, but quality grades given by projects differ significantly	5 articles re-assessed by several WP	1	3	0
An article belongs to one or several WP but has never been assessed	5 articles requested for assessment by a WP for the first time	1	0	0
The original assessment of an article is outdated	2 article requests for reassessment by the WP it belongs to	0	0	0
An article does not belong to any WP	2 articles were proposed to relevant WP for adoption	0	0	0

Table 7: Impact of requests for article assessment or reassessment by the Wikipedia community within related WikiProjects (WP). Two impacts were measured a) feedback or comments provided on the talk page as a result of the review publication, and b) improvement of the article in terms of length and quality.

4.6. Calls for the creation of new articles

Two articles were proposed for creation in November 2014 and had been created since then, explicitly as a result of the call for creation (Makhonjwa Mountains[30] and Kaditshwene[31]). A second test has been repeated in January 2016, with two articles proposed for creation. As of end of 2016, they have not been created. It should be outlined that the four articles proposed for creation were rather

[30] https://en.wikipedia.org/wiki/Makhonjwa_Mountains
[31] https://en.wikipedia.org/wiki/Kaditshwene

specialized articles, all directly related with South Africa, hence of no obvious interest for the majority of Wikipedia participants.

4.7. Articles featured on Portal pages

Four South Africa-related articles were featured on the South Africa portal pages from the 6th of November 2015. The outcome shows that only one article was significantly changed and improved shortly after its addition to the portal.

An increase in the number of pageviews for each article was noted after they were added to the portal page. In one case, particularly significantly: increasing from 120 pageviews to 185 per day.

4.8. Call for participation to an online writing contest

The model that included calls for participation involved the two online writing contests "Wikipedia #15Challenge Writing Contest" and the "2016 Africa Destubathon".

The first online contest –"Wikipedia #15Challenge Writing Contest" – was well attended and resulted in the creation of 234 articles overall. It involved a total of 55 participants (27 English speakers, 24 French speakers and, unexpectedly, four Armenian speakers) which produced a total of 71 new biographies on African women in English, 122 new biographies of African women in French and 41 new articles of African women in Armenian.

Amongst the 71 new biographies written in English, seven were about South African women.

The contest was considered highly successful and raised the attention and interest of many wikipedians who are interested in seeing more African Women featured on Wikipedia.

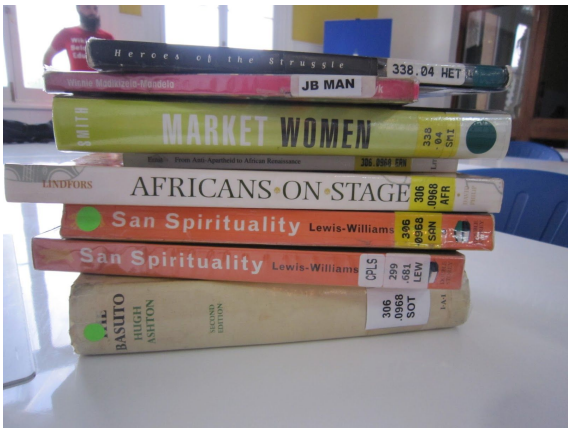
The second online writing contest was even more successful. At the end of the contest, all seven articles listed as part of the Primary School project had been improved, three of them significantly, making it our most efficient strategy so far.

Of the four articles[32] listed in the quintuple score, only one was significantly improved. It should be noted that all these articles were already pretty well developed articles, requiring a certain degree of expertise, and in one case very controversial (the article about Apartheid). The five points could only be granted if the article was improved *and* it was awarded a Good Article assessment that requires significant effort to attain.

4.9. Edit-a-thons organised in South Africa

The edit-a-thon organised in December 2015 did not succeed to reach a significant attendance. The edit-a-thons organised in February 2016 received six and four participants respectively, not counting trainers, facilitators, or wikimedia volunteers. During the edit-a-thons organised in February, edits and additions to a limited extent were made to eight articles. However, most of these articles were not in the original list of suggested articles.

[32] The articles listed for quintuple scores were Apartheid, Herero and Namaqua genocide, Saartjie Baartman, and San people.




Figures 16-19*: The second Primary School Edit-a-Thon on the 19 February 2016 at the Cape Town Central Library in Cape Town, South Africa. C*C-BY-SSA *4.0. Authors: Discott (*photo *16), Islahaddow (photos 17-19).*

Overall, the results were rather modest both in terms of numbers of participants and in terms of edits made[33].

4.10. Edit-a-thons organised by other parties

The articles on to do lists that were suggested to other parties did not receive any interest from potential editors. None of the nine articles proposed to the AfroCROWD list or for the "WikiProject Occupational Safety and Health" meetups were improved after they were listed.

4.11 Articles that were changed as a result of community involvement

The Wikimedia community was the most effective in changing articles. Their involvement showed how article evolve, are renamed, deleted or changed and how all materials creates a lively discussion.

For example, during the course of the project, many articles were renamed, this is a sign of community care:

- African music – became Music of Africa

[33] More information about the South Africa edit-a-thons: https://meta.wikimedia.org/wiki/Primary_School_Edit-a-Thons

- Automobile – became Car
- Bill of Rights (South Africa) – this article has become Chapter Two of the Constitution of South Africa
- Decanting – became Decantation
- Hottentot Venus – became Saartjie Baartman
- Khoikhoi mythology – was deleted
- Mapungubwe – became Kingdom of Mapungubwe
- Reconciliation Day – became Day of Reconciliation
- Republic of South Africa – became South Africa
- San languages – became Khoisan languages
- Sieving – became Sieve
- 2 ft gauge railways in South Africa – became Two-foot-gauge railways in South Africa
- Animal-powered transport – became Outline of animal-powered transport
- Gender stereotypes – was deleted
- Processed food – became Convenience food
- Mapungubwe Museum– became Mapungubwe Collection
- Gana and Gwi people – became San people.

5. Data visualisations

During the course of the project several visualisations were made with the aim to visually evaluate the evolution of the Wikipedia articles. Specifically, the visual evaluation had three main goals:

- to analyse the state of the relevant articles at the start of the Wikipedia Primary School project,
- to evaluate the project's impact on Wikipedia content, and
- to support the research activities by providing general and specific views of Wikipedia articles over time.

To reach these goals, the data visualisations were conceived as small multiples[34] with the aim of providing a general overview, as well as a detailed focus on the articles.

After a preliminary analysis of the data available and some meetings, four aspects were identified for the visualisations:

1. The connection between articles.
   This refers to the relationships between articles in terms of interlinks. In order to analyse this, a network of articles was needed. The network made it easy to understand the connections and the clusters between articles. Furthermore, since an article can be easily reached (and edited) if it has a certain amount of links that point to it, we investigated the classification or typology, and the amount of incoming and outgoing links. In specific, we considered the links from and to other articles, portals, user pages, templates and categories.
   The articles under examination were very different in term of length and number of links. They also varied from general terms to local events to specific topics. The main hypothesis was that we would have a wide spread of articles over the network.
2. Article evolution.
   This aspect refers to the frequency and the size of the edits. We wanted to visualise all the edits, from when the article was created, in order to discover a pattern in the causal edit of articles. The intent was to graphically show the impact of the project and the patterns in the causal edit of the articles. We presumed that the more popular articles were regularly edited over the entire "life" of the article, and that some articles might be controversial.
3. Article views.
   To analyse this aspect we took into consideration the number of pageviews and the Google Page Rank for each article. Through the visualisation, we expected to see the most and the least popular articles.
4. Integration of resources within the articles.
   With the term "resources" (also called "features" in the visualisation sheets) we refer to some references that can support the user in their interpretation of the subject as they read the articles. Specifically, we identified: the references, notes, images and the See also sections[35]. With this in mind, we sought to show some of the challenges or problems that could lead to misunderstandings or a lack of comprehension of the topic. Since the articles are very diverse, we expected to have a very diverse dataset. We also assumed that an article with fewer resources would have more challenges and therefore would be less easy for readers to understand.

[34] The small multiples are a series of similar graphs or charts using the same scale and axes, allowing them to be easily compared.
[35] In Wikipedia, the "See also" section provides links to other articles that are related to the subject matter.

5.1 Methodology

The visual evaluation started after the list of 174 articles was identified and examined (in the course of the project two articles were created and added to this list). A total of 60 articles on the list were improved as a direct result of the project's activities. The rest of the articles were taken into consideration in order to compare the improvements to the articles as a result of the project with the usual evolution of articles on Wikipedia.

The visual evaluation process took place over three main phases. Each phase consisted of a cycle of the conceptualisation and design of the chart, data gathering and visualisation, and a review with the Wikipedia experts, and then refinement.

The first phase aimed at providing an overview of the status of the selected articles, and to validate any hypothesis that is raised with a definition of what aspects were needed to be evaluated. In this phase, all the aspects that were identified were investigated through six data visualisations.

The second phase, that took place six month after the first one, aimed to evaluate the first results of the research project[36]. The initial list of articles had to be reviewed because of some changes in the articles made by the Wikipedia community[37].

The final phase aimed at analysing the state of the articles at the conclusion of the project and to gather insights for further research projects.

A set of visual models were designed according to the aspects that the research team believed defined the articles at the beginning of the evaluation process. These aspects per article were:

- The network of incoming and outgoing links
- The balance between incoming and outgoing links
- A timeline of the edits
- A timeline of page views
- The balance between the issues and the content that support the reading (references, notes etc.).

Parallel to the creation of the data visualisations, a web page was implemented to collect the list of articles and their related data[38]. The webpage displayed the number of: incoming and outgoing links, issues, references, notes and images. Every single record is graphically visualised in red or green according to either its increasing or decreasing value.

[36] In the second phase of the visual evaluation process, 35 articles were improved thanks to the involvement of the Wikipedia community and 25 were improved by domain experts.
[37] Many articles were altered by the Wikipedia community in terms of title or in term of integration in other articles.
[38] The following is the link to the web page with the list of the articles:
https://giovannipro.github.io/wikipedia-primary-school/.

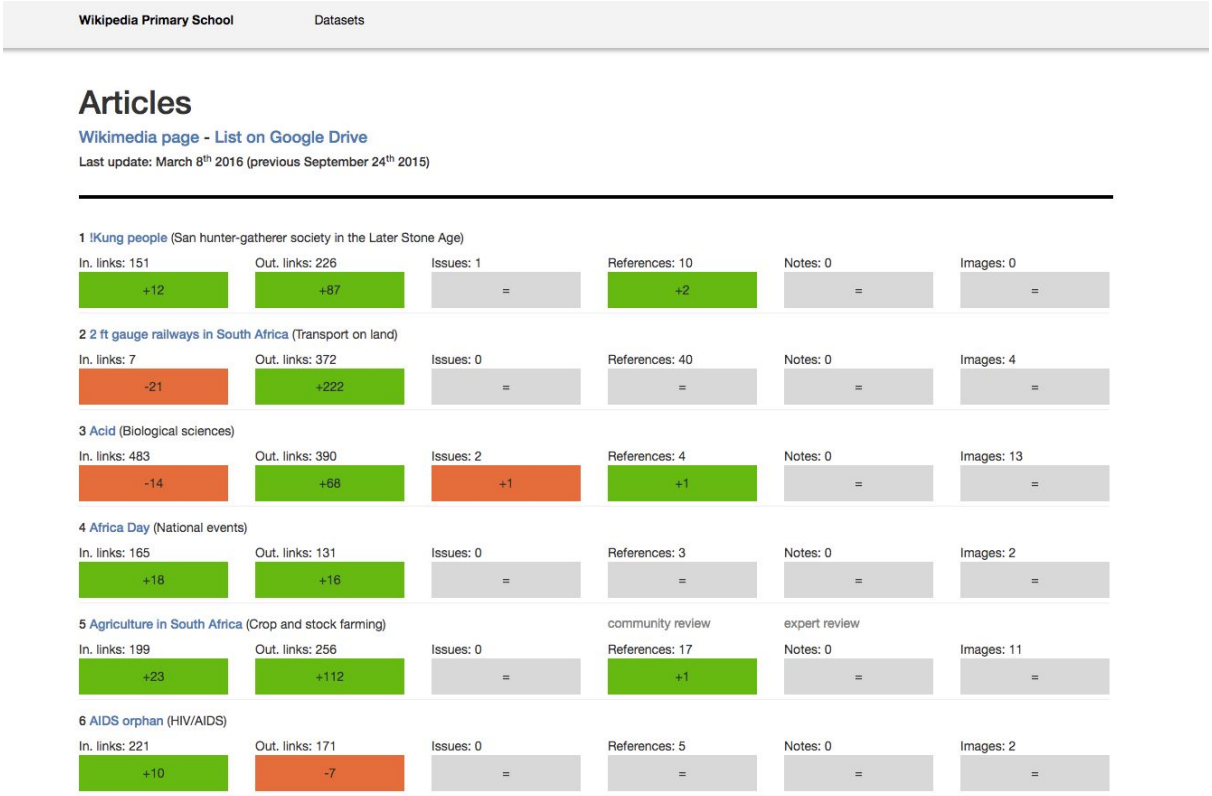


Figure 20: Screenshot of the website created to visualise the incoming and outgoing links to articles.

All the data needed to make the visualisations were gathered via a web scraper (called Wikimole created for the project)[39]. The Wikimole was written in JavaScript, with the integration of a PHP script to gather Google PageRank. The gathered data was then cleaned and filtered on Excel.

To make the data visualisations consistent over the three project phases, specific protocols were defined for every single visualisation[40]. The protocol consisted of a series of procedures that were applied from the web scraping to the final presentation.

The following is the set of protocols used to gather and display the articles data.

Articles network

Two approaches were used to visualize the network ofarticles : the first approach considered the articles and their related incoming and outgoing links, the second,considered the articles and the number of incoming links that they have in common.

By using the first approach, two different datasets were used to visualise the network connecting each article. For the network related to incoming links, we used the data coming from the Wikipedia API[41]. For the network related to the outgoing links, we scraped the links from the body of the article. In

[39] Link to the Wikimole scraper on GitHub: https://github.com/giovannipro/wikimole.
[40] Link to the webpage containing the protocols used to gather and visualize the articles data: https://giovannipro.github.io/wikipedia-primary-school/protocols.html
[41] Query to get links to the article on Mahatma Gandhi using the Wikipedia API: https://en.wikipedia.org/w/api.php?action=query&list=backlinks&bllimit=500&format=json&bltitle=Mahatma_Gandhi. For technical reasons, the number of incoming links was limited to 500.

both cases, we considered the data gathered in a specific moment in time. The links from and to special pages and to external pages were excluded from the dataset.

The datasets were divided in two: nodes and edges. The nodes were compiled from the list of the article pages and their related unique id. The edges were compiled from the list of the article pages and the incoming and outgoing links.
Edges and nodes were imported into Gephi[42], and plotted using the Force Atlas 2 layout[43], with the overlap prevention. A filter was applied (degree range beneath 5) in order to hide the smallest pages from the network . All the nodes were scaled according to the numbers of incoming/outgoing links. The obtained network was then exported and finalised in a graphics software.

By using the second approach, the data about the incoming links was collected with the aim of visually exploring the correlation among the articles under consideration. Every article is represented by a bubble. The bigger the bubble, the more incoming links it has. The closer the bubbles are to each other, the more links they have in common. The colours represent the clusters of articles.

Just as in the previous approach, the dataset was divided in two: nodes and edges. The nodes were compiled from the list of the article pages and their related unique id. The edges were compiled from the list of couples of article pages and the number of incoming links they have in common.

Edges and nodes were imported into Gephi and plotted using the Force Atlas 2 layout, with the overlap prevention. The obtained network was then exported and finalised in a graphics software.

The balance of incoming and outgoing links

The chart reflecting incoming and outgoing links was realised using the data gathered from the Wikipedia API (the incoming links) and from scraping each Wikipedia article on the list. The links gathered for every single article was then divided by typology into links from and to articles, user pages, category pages, template pages, portals (the links from and to special pages and to external pages were excluded from the dataset). The final datasets were visualised through a double bar chart by using the D3.js JavaScript[44] library.

Timeline of the edits

The data related to the edits of the articles were gathered using the Wikipedia revision API. The dataset collected the revisions from January 2001 (when Wikipedia was launched) to December 2014. The dataset was then visualised using a line graph (from the D3.js JavaScript library) that shows the number of bytes added or removed over time.

Timeline of page views

The data on the article page views of each article was gathered using the "Wikipedia article traffic statistics". The Google Page Rank was gathered by using a ready-made PHP script. The page views span from January 2014 to December 2014. The Google PageRank refers to the time when the data

[42] Gephi is an open software for the exploration and analysis of networks. https://gephi.org/
[43] Force Atlas 2 is an algorithm used for network spatialisation.
[44] D3.js is a JavaScript library for the visualisation of data on the web. It is based on basic visualisations component and a data-driven approach to DOM manipulation. https://d3js.org/

was gathered (August 2015). In the first phase, the data was later visualised in an area chart by using the D3.js JavaScript library. In the final phase, due to some very high peaks, we visualized the data through the horizon chart[45].

The balance of issues and content in articles that support reading

For this protocol, the article pages were scraped and parsed through a script in JavaScript. The following data was collected: number of issues[46], number of references, number of notes, number of images and number of "See also" links. The dataset was visualised in a double bar chart using the D3.js JavaScript library.

5.2 Design of the visualisations

The visual models were designed to facilitate the discovery of articles that needed improvement. Thus, a major aspect of the visualisations consists of visual representations of data related to the articles, in ascending order of value. The networks are made by using the software Gephi. All the other charts are made by using the JavaScript library D3.js.

During the design process, we dealt with several issues, both from a design and a technical point of view. From the design point of view, we encountered the need to combine the general overview of the articles' set with the clear representation of the data related to every single article. Through the use of multiple charts and histograms in the final designs, we tried to combine these two aspects.

From the technical point of view, we encountered the following two issues: changes to the title of some articles (the article being deleted or merged into another article) and the use of unstructured data, such as the number of images and article issues.

With regards to the first issue, a script was written with the goal, at the beginning of the data gathering process, of checking all redirections or article deletions.

For the second issue, a series of sample checks was made in order to verify the reliability of the scraper script and the quality of the data gathered.

The following section details every single visual model that was produced. Further information about the visualisation can be found on the evaluation page[47] of the Wikipedia Primary School project. The complete high resolution set of visualisations (Figures 21-31) are available on Wikimedia Commons, under the category *Wikipedia Primary School SSAJRP visuals*[48].

Articles network

The visualization in Figure 21 shows the relationships among the selected articles in terms of what interlinks they have in common. Every bubble represents an article. Articles with incoming links in

[45] The horizon chart combines position and color to reduce vertical space. Starts with a standard area chart, then it offset the highest values and give them a darker color.
[46] Article issues refers to the infoboxes that contain the problems the article has, such us the lack of neutrality, the need of references, the lack of links to other articles etc.
[47] https://meta.wikimedia.org/wiki/Research:Wikipedia_Primary_School_SSAJRP_programme/Evaluation
[48] https://commons.wikimedia.org/wiki/Category:Wikipedia_Primary_School_SSAJRP_visuals

common are connected through curved lines. The size of the bubbles shows the amount of incoming links. The closer the bubbles are to each other, the more links they have in common. Bubbles with the same colour are clusters of articles that have a large number of incoming links in common.

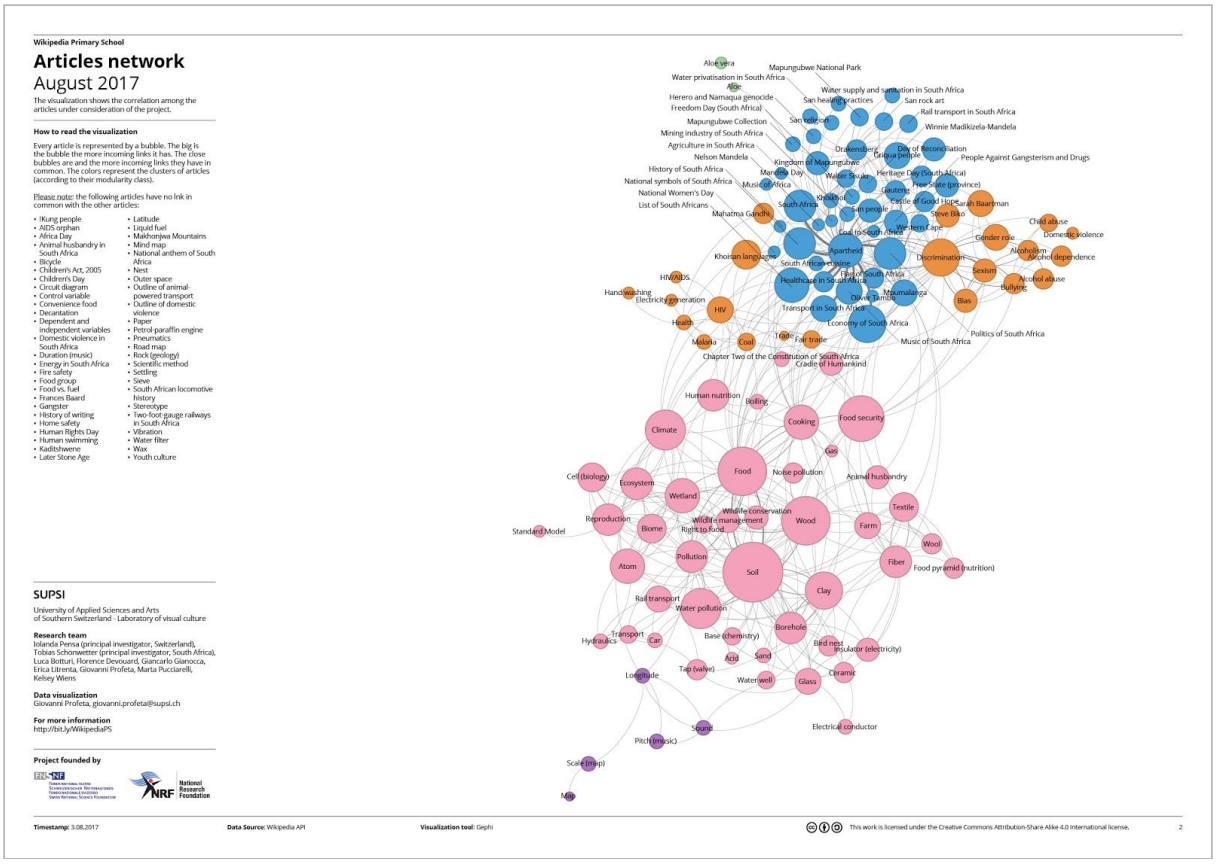


Figure 21: Articles network. This visualisation was made on 3rd of August 2017. visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0. https://upload.wikimedia.org/wikipedia/commons/b/bf/Wikipedia_Primary_School_20170811_articles_network_2017.jpg

Networks of incoming and outgoing links

The visualisations in Figure 22 below shows the relationships among the selected articles in terms of interlinks between articles. Every article is shown as a bubble. Every link is shown as a line between two bubbles. The size of the bubbles shows the amount of incoming or outgoing links. The closer the bubbles are to each other, the more interconnected the articles are. Bubbles with the same colour, highlighted by circles, are clusters of articles that have a large number of incoming or outgoing links in common.

The visualisation represents the moment in which the data was scraped (in this case August 2017).

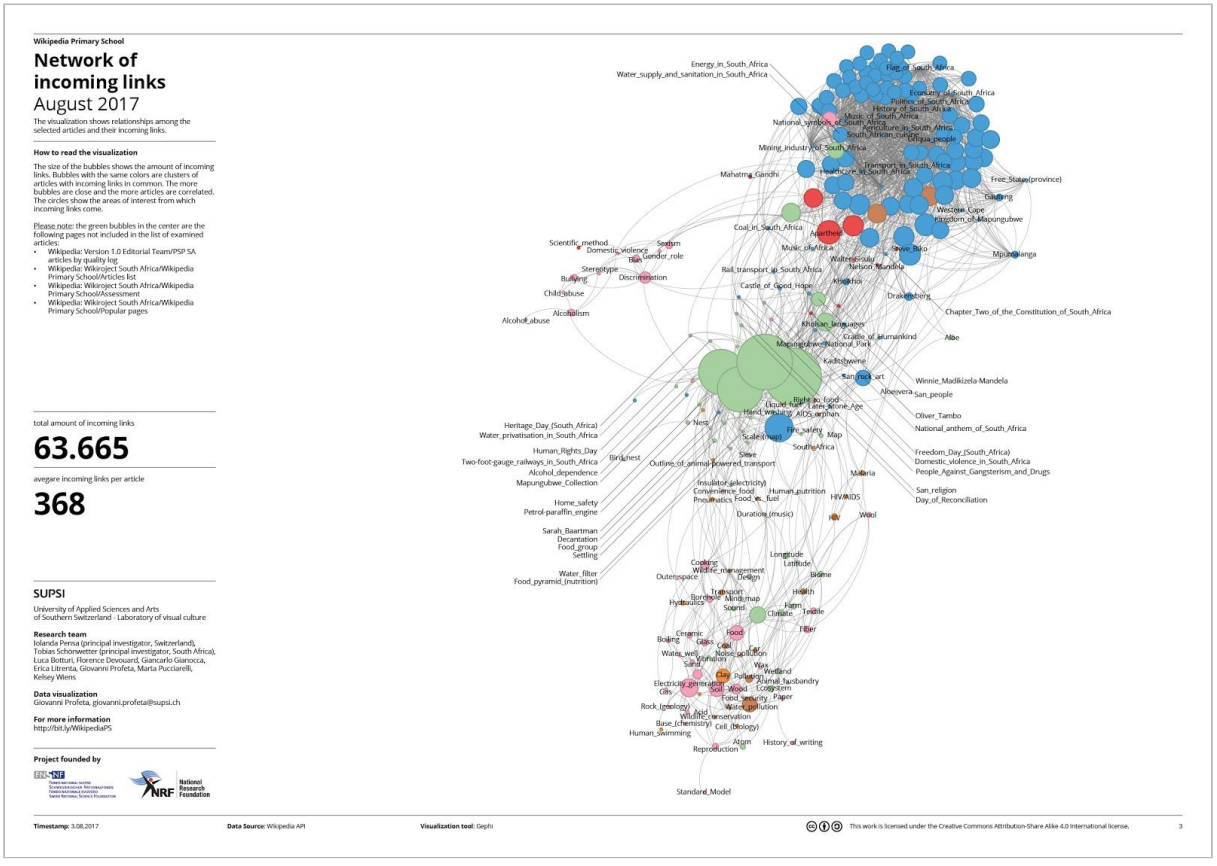


Figure 22: Network of incoming links. This visualisation was made on 3rd of August 2017. visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Wikipedia_Primary_School_20170811_articles_network_2015.jpg

Incoming and outgoing links balance

The visualisation in Figure 23 shows the balance between incoming and outgoing links[49]. At the top, the bars show the amount of incoming links. At the bottom the vertical bars show the amount of outgoing links. The colour of the bars shows the typology of the page: article, users page, category page, template page and portals. From left to right, articles are in ascending order of incoming links. Since the links from other articles are the very majority part of the interlinks, we decided to make the visualisation represent the moment in which the data was scraped (in this case August 2017 and August 2015).

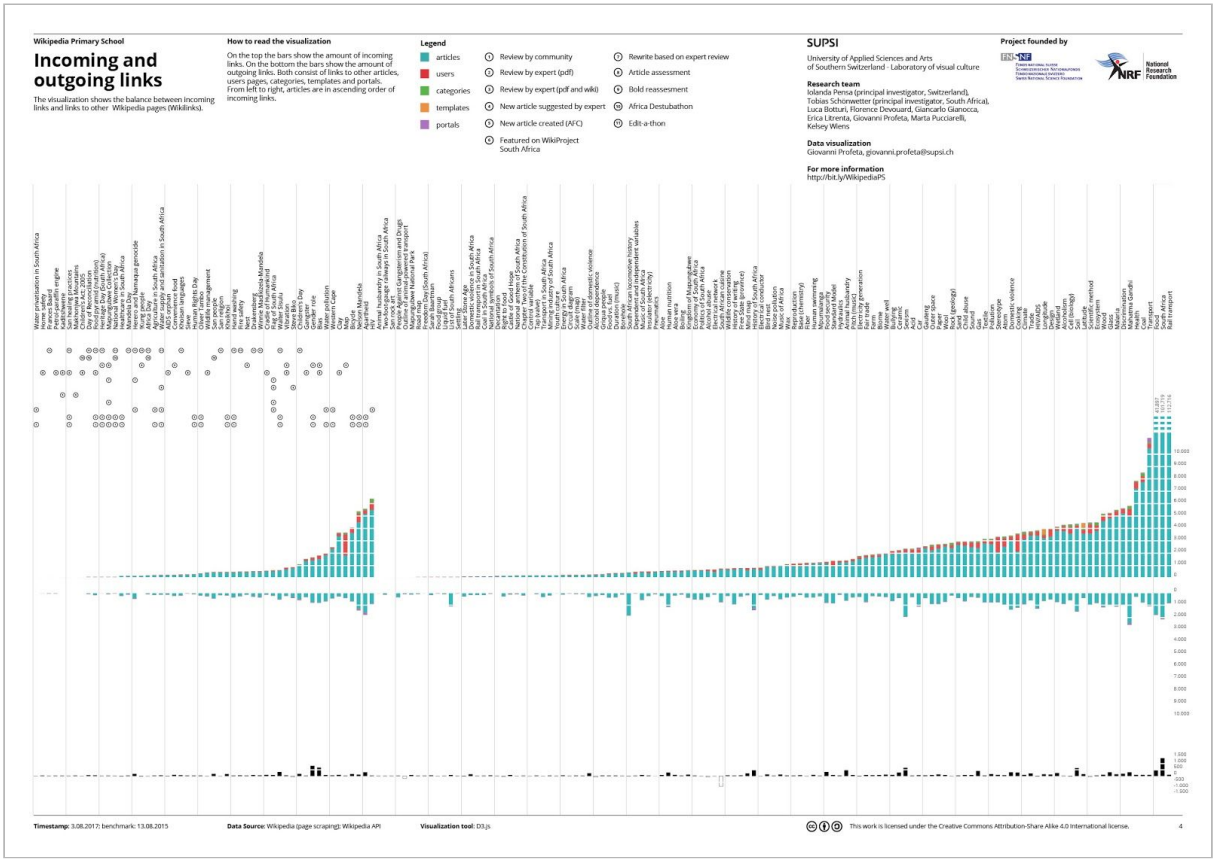


Figure 23: Incoming and outgoing links balance. The visualisation was made on the 3rd of August 2017. A Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Wikipedia_Primary_School_20170811_in_out_links.jpg

[49] For the balance of incoming/outgoing links, we only considered the links from and to Wikipedia pages.

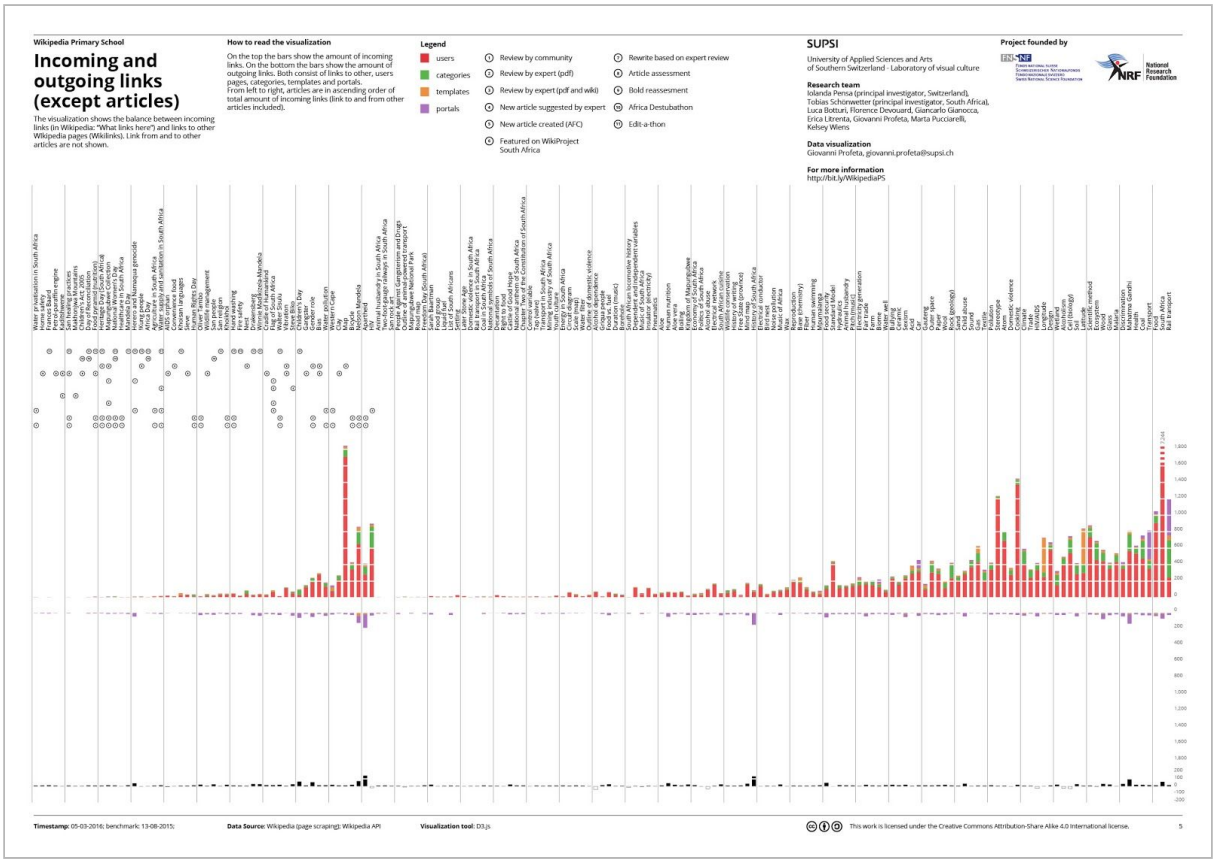


Figure 24: Incoming and outgoing links balance (except articles). The visualisation was made on the 3rd of August 2017.

A Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:Wikipedia_Primary_School_20170811_in_out_links_no_articles.jpg

Timeline of the edits

The visualisation in Figure 25 shows the edits in terms of difference of size (in bytes) from one revision to the next. The line chart goes up if some bytes were added and goes down if some bytes were deleted. From top to bottom and from left to right, articles are in ascending order of the size of the revisions.

This visualisation represents edits from January 2001 (when Wikipedia was launched) until December 2014.

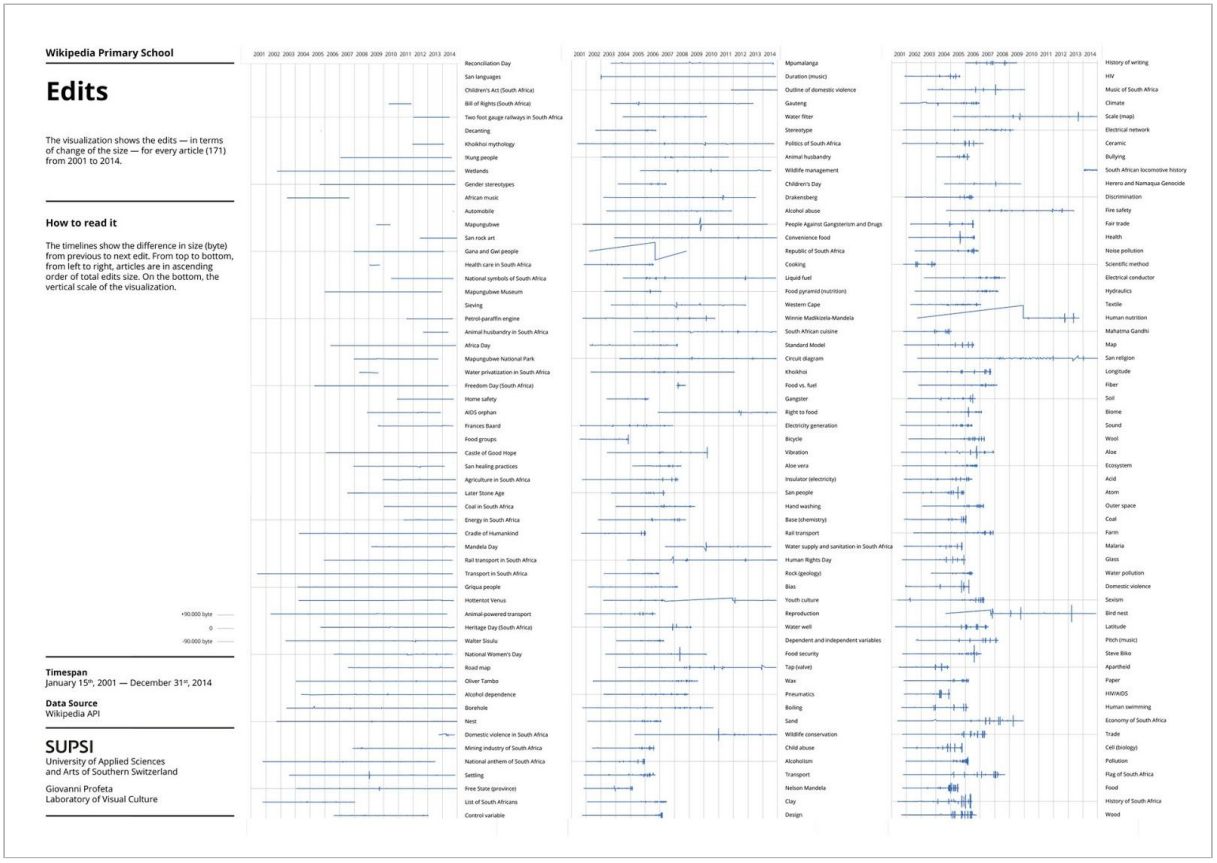


Figure 25: Timeline of the edits to the articles from January 2001 (the time of Wikipedia's launch) to December 2014. The visualisation was made on August 2015. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://meta.wikimedia.org/wiki/File:Wikipedia_Primary_School_20150821_edits.jpg

Timeline of page views

The visualisation in Figure 26 shows the number of the daily page views of the articles. The related Google PageRank is also shown next to the title of the article. From top to bottom, from left to right, articles are in ascending order of the total amount of pageviews. The visualisation represents the period from July 2015 until June 2017.

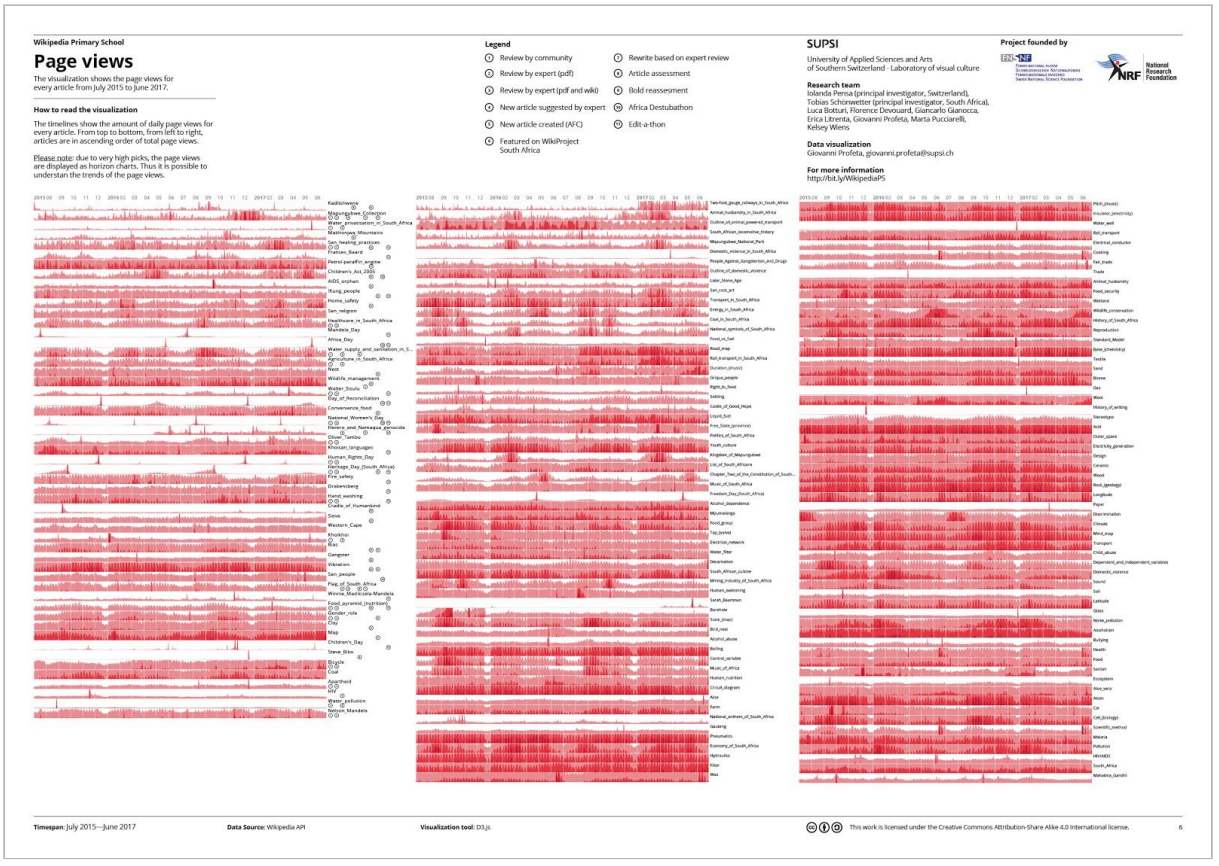


Figure 26: Timeline of the articles' pageviews from July 2015 to June 2017. The visualisation was made on August 2016. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Wikipedia_Primary_School_20170811_page_views.jpg

Balance of article issues and content to support the reading

The visualisation in Figure 27 shows the amount of issues, references, notes, images and "see alsos" for every article. At the top the bars show the number of issues. At the bottom the bars show the amount of references, notes, images and "See also". From left to right, articles are in ascending order of features. The issues and the other data are shown with two different scales.

The visualisation represents the moment in which the data was scraped (August 2015 and March 2016).

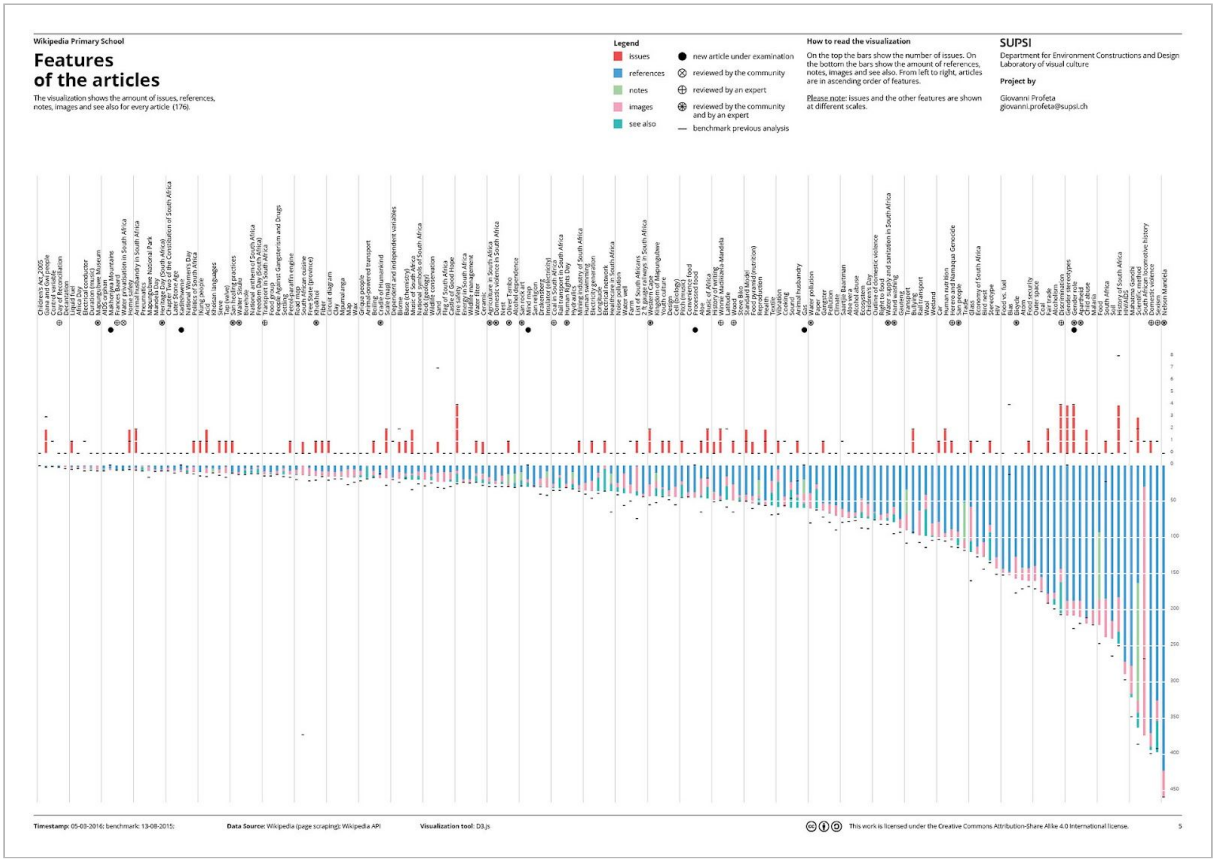


Figure 27: Balance of articles' features: issues, references, notes, images and see also. A visualisation made on the 5th of March 2016 by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0. https://meta.wikimedia.org/wiki/File:Wikipedia_Primary_School_20160306_features_of_articles.jpg

5.3 Insights

Over the three-years project, many changes happen to the articles. First of all, several articles changed their title (among them: Automobile became Car, San languages became Khoisan languages, 2 ft gauge railways in South Africa became Two-foot-gauge railways in South Africa) and several articles were deleted (such us Khoikhoi mythology and Gender stereotypes).

In the next paragraphs, we briefly describe the information about the articles we were able to gather through the use of the visualizations and the changes due to the research activities.

Articles connections

By visualizing the network of articles it is possible to make some conclusions about the relevance of the articles and their relations.

The variety of dimensions of the bubbles, in the incoming and outgoing links network, shows the wide differences, in terms of relevance, among articles. The colours of the bubbles, applied according to their modularity class (the measure of the strength of division into modules), allowed us to identify clusters of articles. Among them there are: articles about South Africa, about diseases and about materials.

Through the comparison of the network of articles made at the beginning and at the end of the research project it is possible to see that the articles related to South Africa (the blue bubbles) have come much closer to each other. This is due to the fact that this cluster of articles now contains more interlinks to each other (with a related increasing of findability).

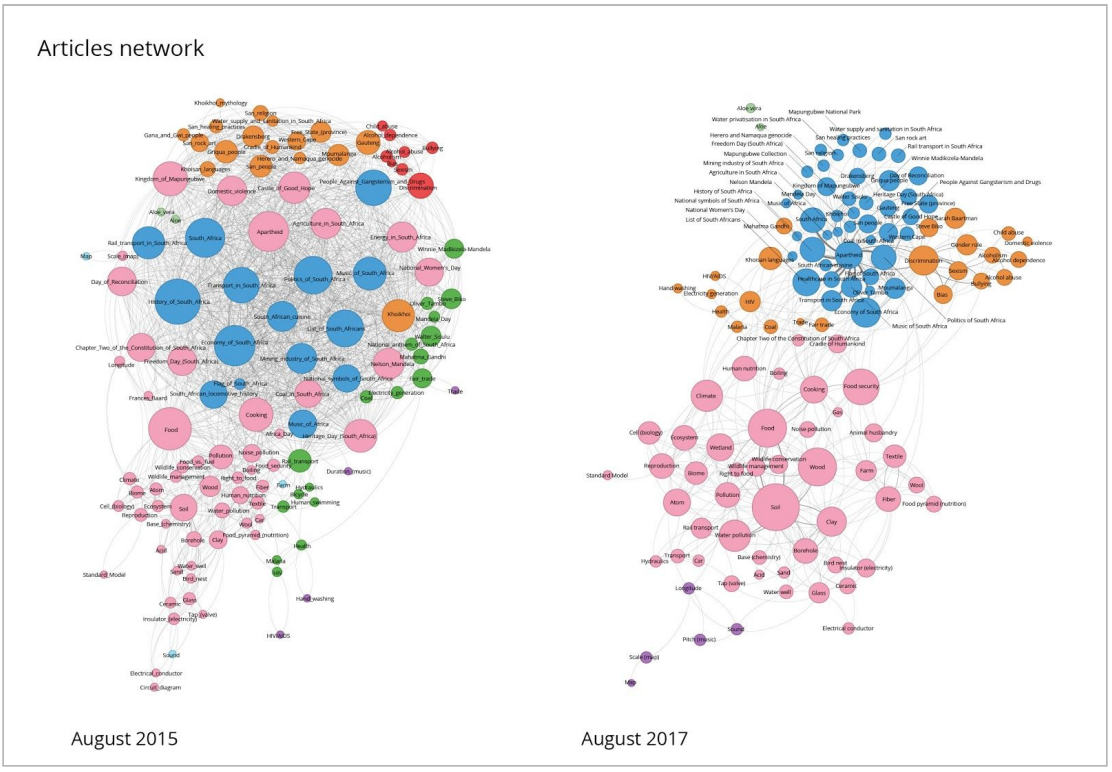


Figure 28: Comparison of articles network in August 2015 and August 2017. A visualisation made on the 3th of August 2017 by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:Wikipedia_Primary_School_20150821_articles_network.jpg

Articles pageviews

The visualization of page views allows us to gather some general information about the use of Wikipedia. Generally, people read articles mostly during the week. The months in the year with fewer pageviews are July, August and December. Articles about annual events, such as Mandela Day, usually receive a peak visits in the day of the event.

The Wikipedia Primary School project does not seem to have had an impact on the page view trends.

Articles features

The visualization of the article's features has shown that the number of issues and all the other features are not correlated to each other. Through the visualization, it is possible to observe that the best strategies to improve the articles were the article assessment and the review by experts. Both contributed to removing any issues and to increase the number of features.

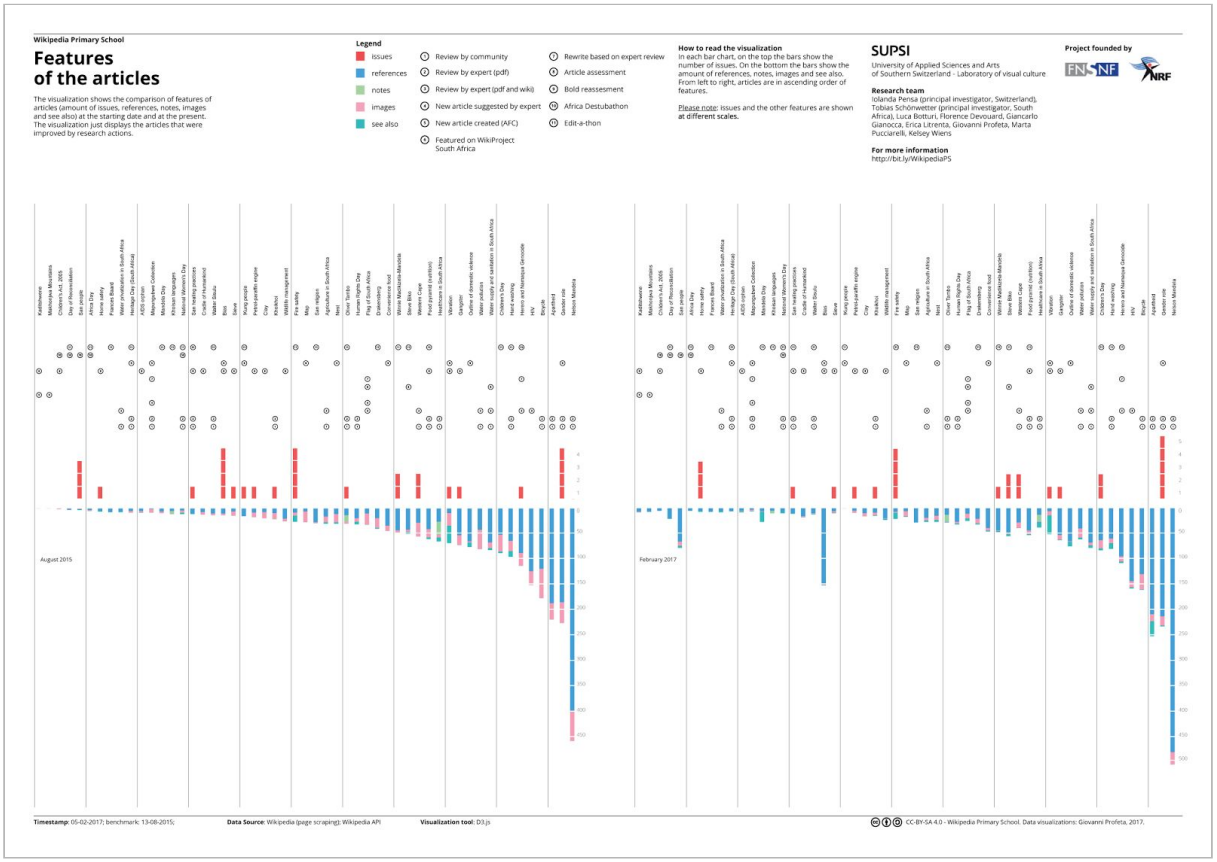


Figure 29: Comparison of the articles' features on August 2015 (on the left) and on March 2016. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:20170319_wps-features.jpg

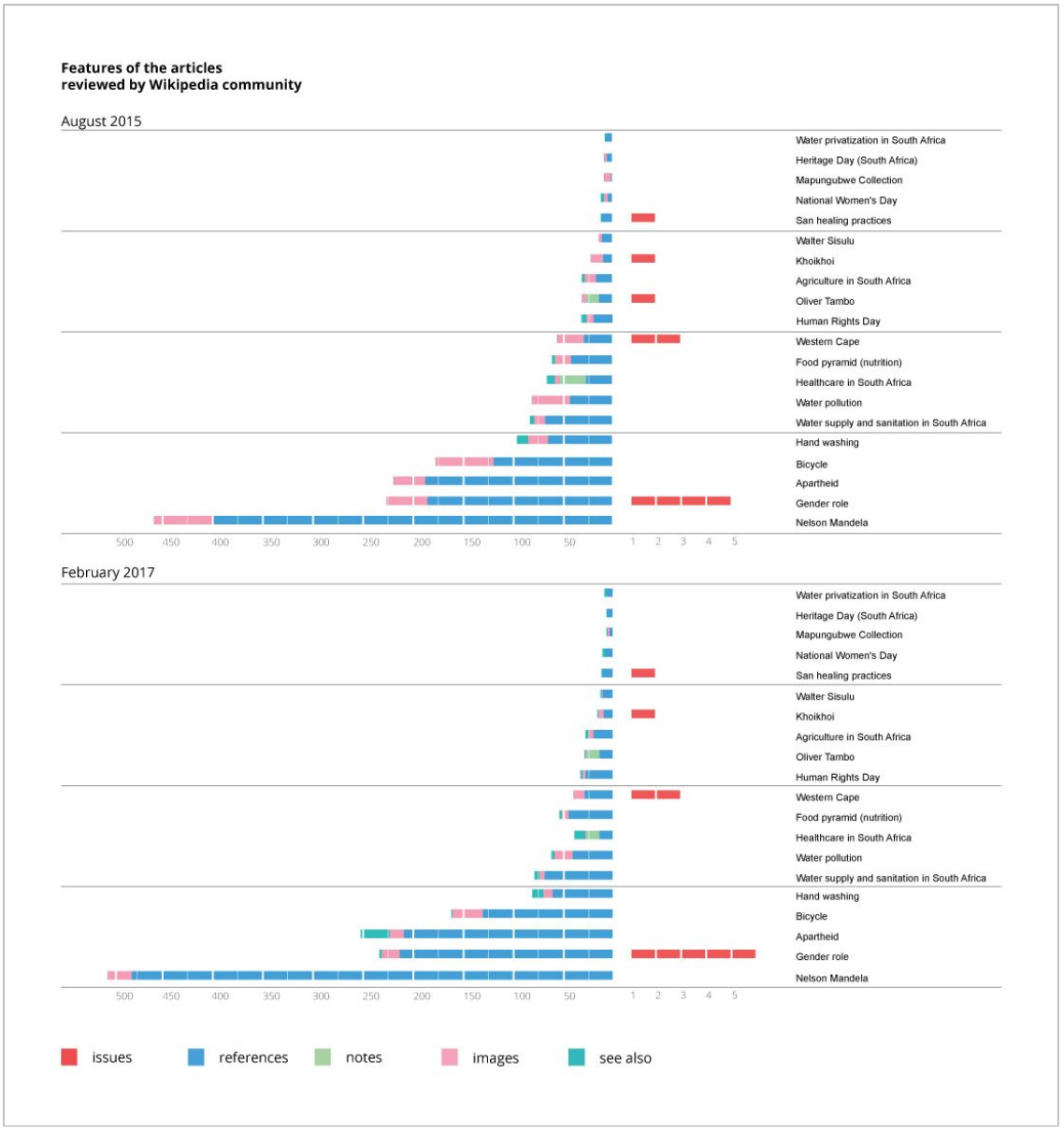


Figure 30: Comparison of the articles' features on August 2015 (on the top) and on March 2016 (on the bottom), of the articles reviewed by the Wikipedia community. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0. https://commons.wikimedia.org/wiki/File:WPS_-_features_of_the_articles_under_examination.png

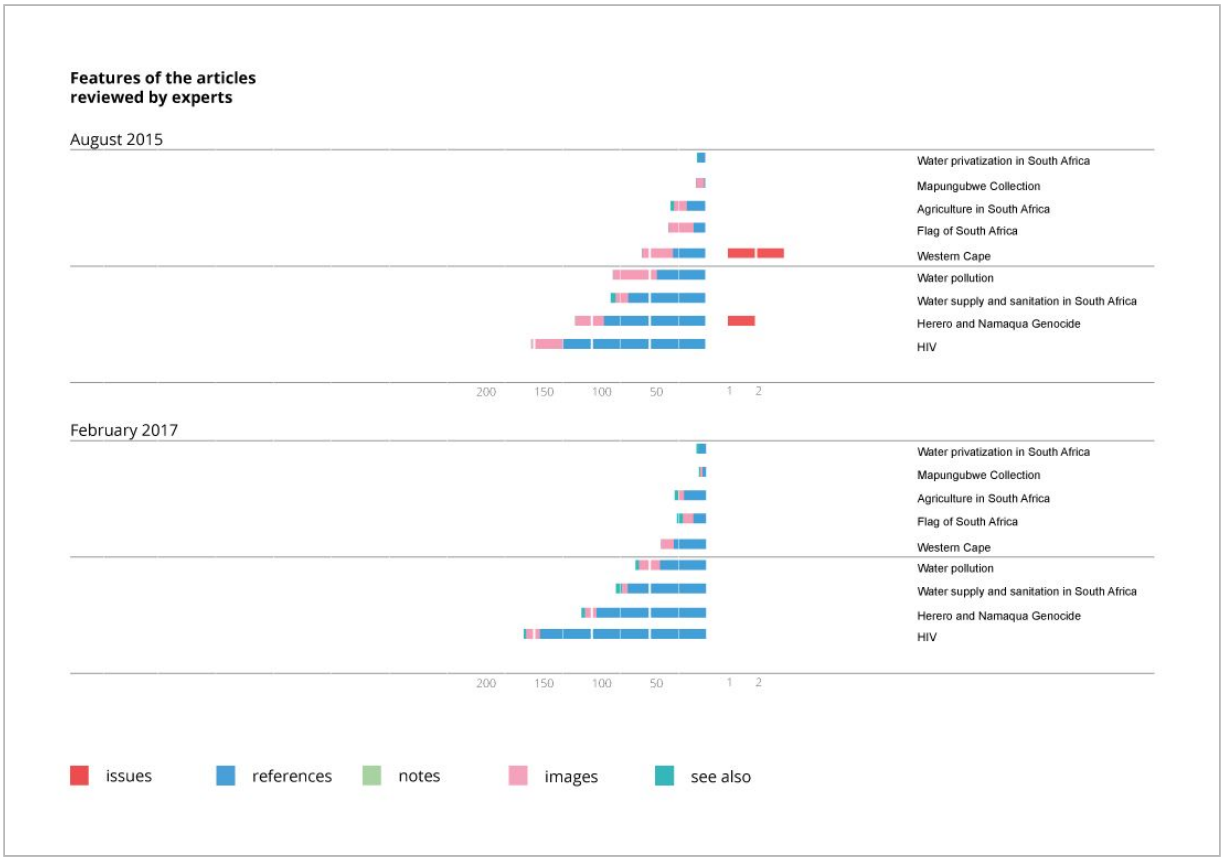


Figure 31: Comparison of the articles' features on August 2015 (on the top) and on March 2016 (on the bottom), of the articles reviewed by the experts. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:WPS_-_features_of_the_articles_improved_by_experts.png

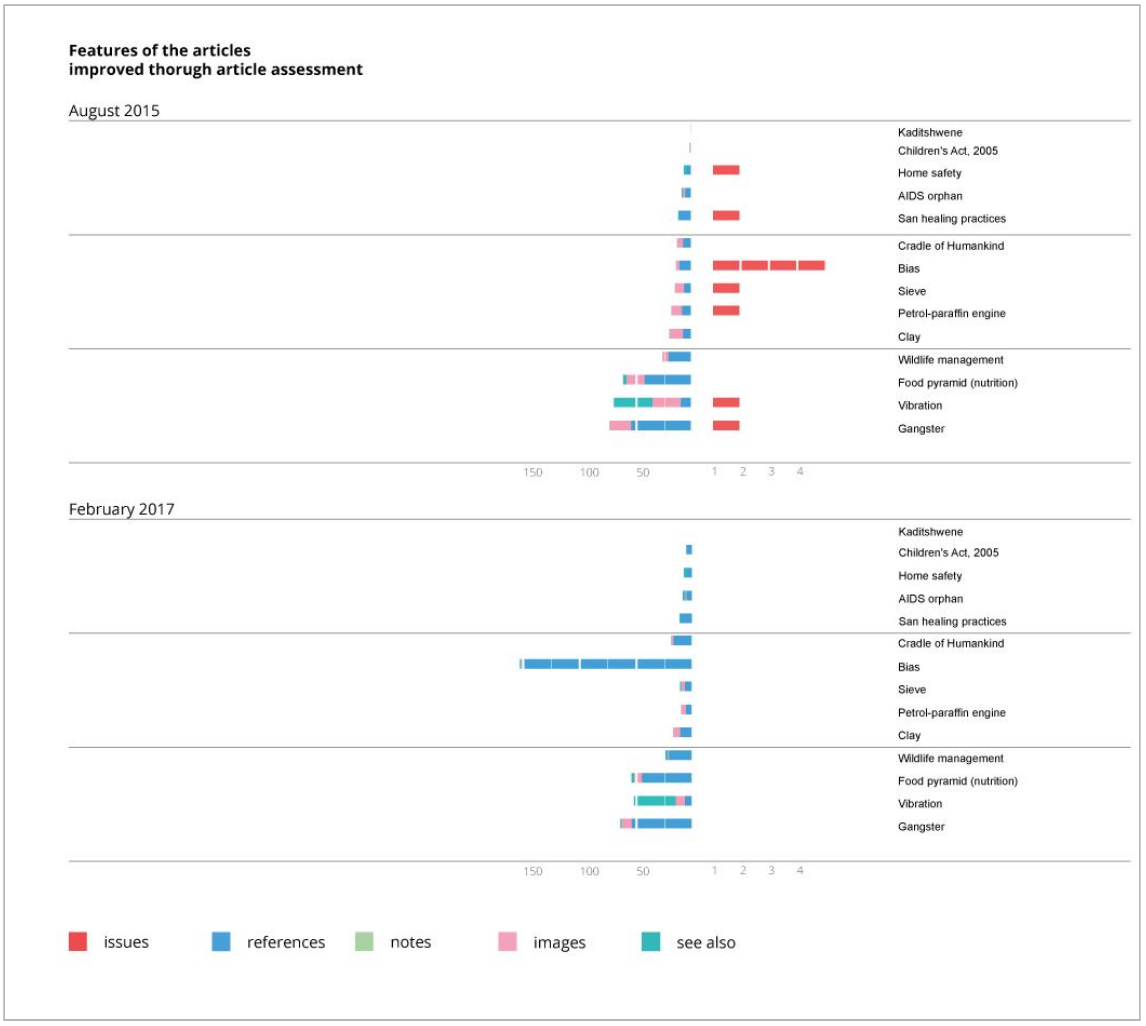


Figure 32: Comparison of the articles' features on August 2015 (on the top) and on March 2016 (on the bottom), of the articles improved through article assessment. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:WPS_-_features_of_the_articles_improved_through_article_assessment.png

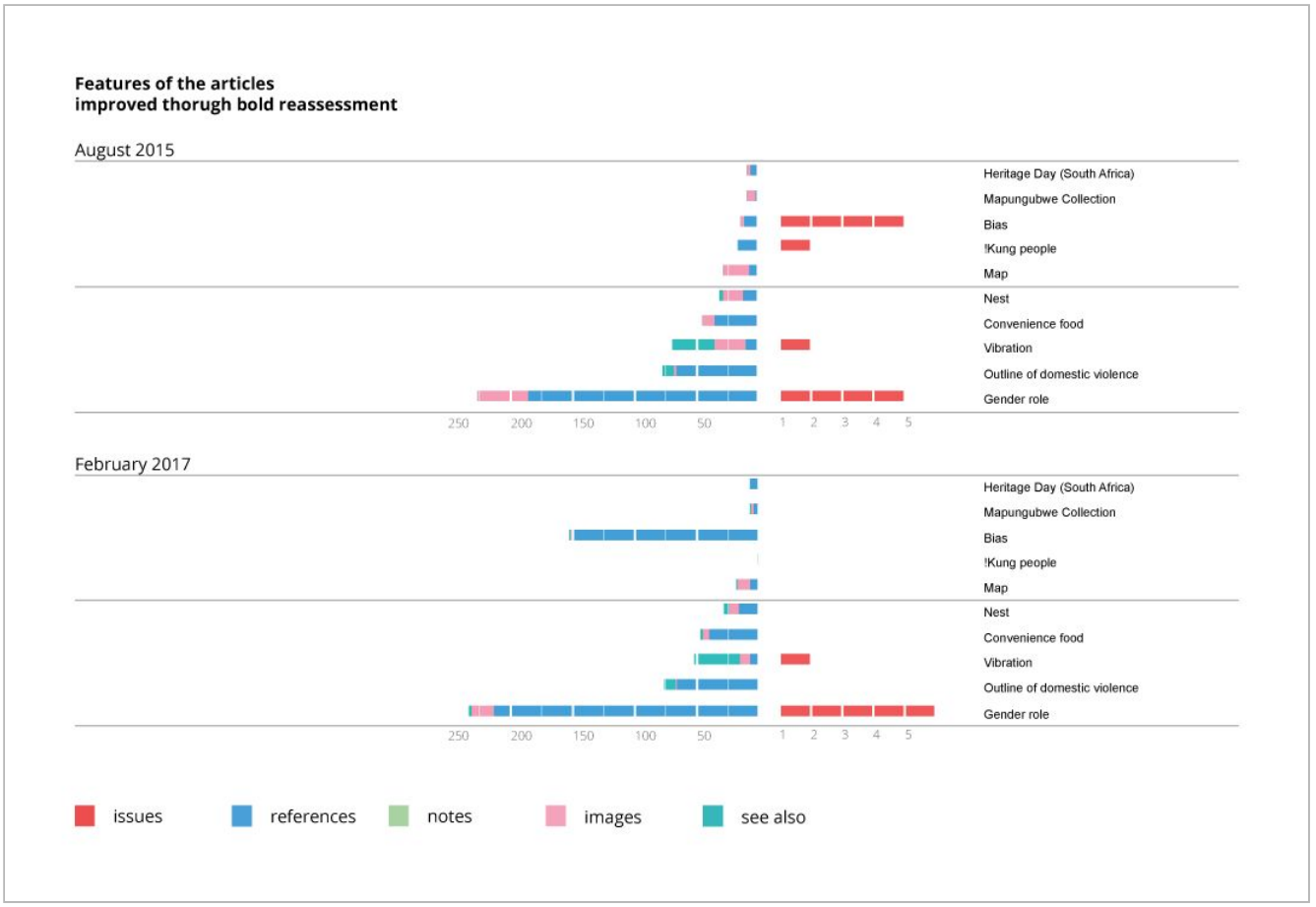


Figure 33: Comparison of the articles' features on August 2015 (on the top) and on March 2016 (on the bottom), of the articles improved through bold reassessment. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:WPS_-_features_of_the_articles_improved_through_bold_reassessment.png

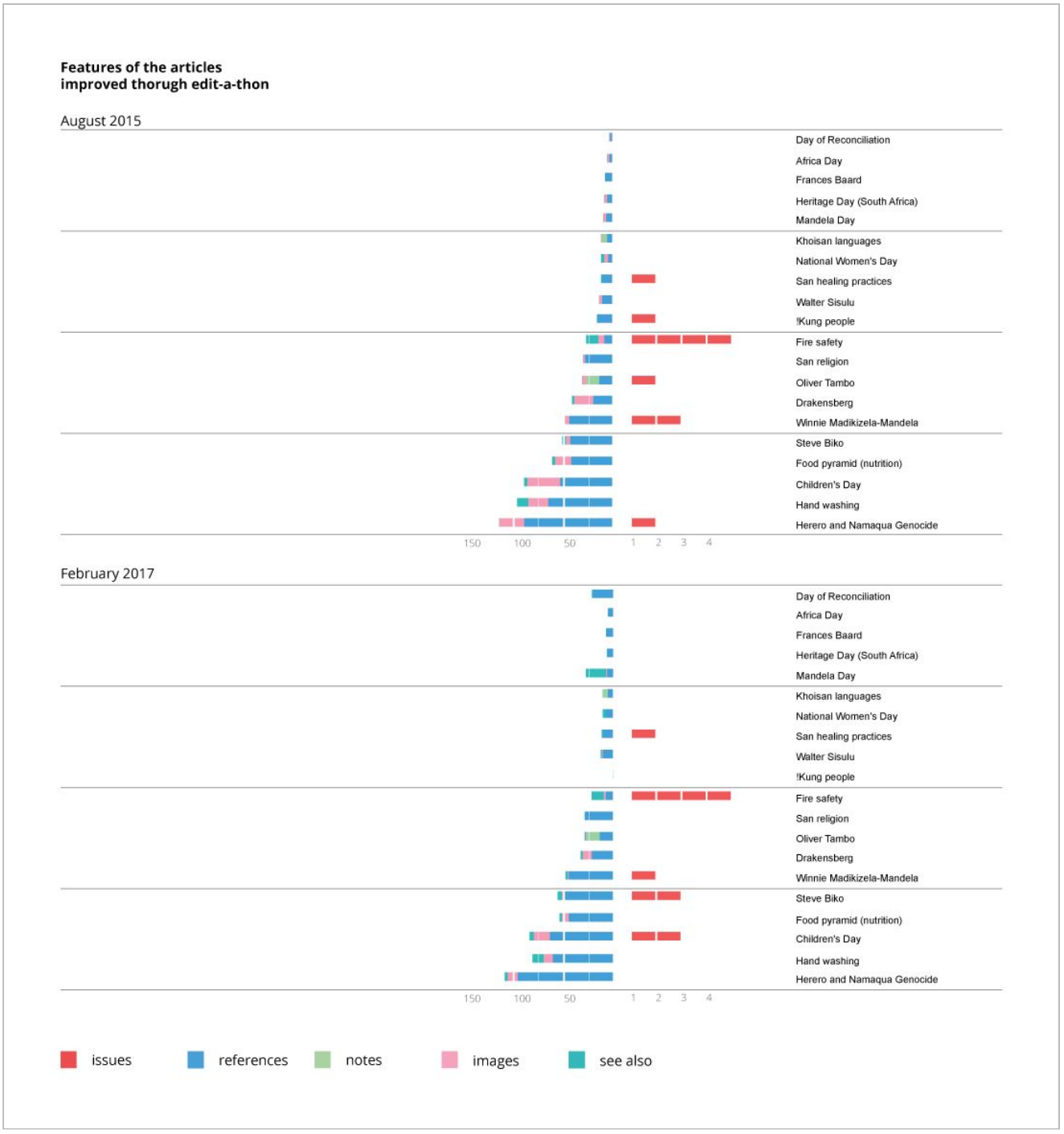


Figure 34: Comparison of the articles' features on August 2015 (on the top) and on March 2016 (on the bottom), of the articles improved through edit-a-thon. Visualisation by Giovanni Profeta for the Wikipedia Primary School Project. CC-BY-SA 4.0.
https://commons.wikimedia.org/wiki/File:WPS_-_features_of_the_articles_improved_through_edit-a-thon.png

6. Key findings

6.1. Common strategies used by the Wikipedia community to trigger article improvement had very little impact

Within the frame of the Wikipedia Primary School project, many of the strategies commonly used by the Wikipedia community to trigger article improvement had very little impact.

Commonly used strategies (such as calls for participation, article creation, or article assessment on WikiProjects talk pages) that this research tested had extremely low impact or no impact at all. Neither of the two article assessments that were updated by community members resulted in any further article improvement. Most of our requests were simply not considered by anyone even though the WikiProject had not been tagged as inactive. In some cases, our request was disregarded in spite of being posted in the dedicated space, whilst the automated log showed regular reassessments of the WikiProject articles. This suggests that although some WikiProjects communities are still active and are regularly reassessing articles, the assessment is being done more or less randomly without a coordinated effort to follow up with any of the requests that are posted. Further investigation showed that whilst some WikiProjects are still active, most are now either dormant or extinct. WikiProjects were set up in the 2007-2008 (Morgan 2013), as part of a global effort by the community, to prepare a print version of Wikipedia. In August 2016, only 37 WikiProjects from a total of 2 466 (1.5%) showed more than 1000 human edits to its pages over the entirety of the previous year[50]

Recommendation systems were developed by the Wikipedia community as a way of leveraging the interests and knowledge of editors (Cosley et *al.* 2007) or drawing attention to tasks that the community deemed were important (Krieger et *al.* 2009). However, many of these systems are now artifacts, designed when the Wikipedia editing community was much larger than it is today. The number of very active editors (more than 100 edits per month) dropped from 4700 in 2007 to around 3000 in 2016[51]. This research project suggests that the over-availability of recommendation systems may blur options, making it more complicated for editors to identify urgent tasks and creating confusion for new editors. This seems supported by other research projects that have tested strategies to elicit lightweight contributions from readers through the moodbar or the feedback tool. The research projects did report some effect but also outlined that methods might not scale due to the work that would subsequently be required of the community (Halfaker et *al.* 2013; Ciampaglia 2015).

The edit-a-thons that are regularly used by the community to trigger content production provided very limited benefit to our research project. There was no public attendance for the first edit-a-thon in South Africa and there is no online evidence that the meetup planned on “Safety and Health Issues” actually took place. This outlines a frequent situation reported by organizers of edit-a-thons, the low level of attendance to most face-to-face events. Additionally, most participants to the other South African edit-a-thons were new participants and most of the time allocated to the event was used to introduce them to Wikipedia rather than actually producing content. A costs/benefits analysis is not very favorable to the edit-a-thon methodology (costly, time-consuming, high-energy for the organizers and the participants) when considering the actual outcome in terms of of content.

Discussions with organizers of meet-ups also indicated that many of those events are actually not

[50] https://en.wikipedia.org/wiki/Wikipedia:Database_reports/WikiProjects_by_changes
[51] https://blog.wikimedia.org/2015/09/25/wikipedia-editor-numbers/

directly productive, being more opportunities to socialize with other active wikipedians. Last, it was pointed out that most regular participants in edit-a-thons choose to work on articles that appealed to them, rather than work on articles from a prescribed list. They also prefer more focused articles rather than ones that tackle broad issues.

6.2. Writing challenges as the best bet for triggering volunteer participation

Writing challenges appear to be our best bet for triggering volunteer participation and stimulating the writing of new Wikipedia articles or the improvement of very short poor quality articles. They are comparatively low cost compared to other types of efforts such as edit-a-thons or calls to editors around the world, and appear to have more impact from a production point of view.

In order to increase and enhance user-generated content contributions, it is important to understand the factors that lead people to freely share their time and knowledge with others (Nov, 2007). In their influential study of volunteers' motivations, (Clary et al., 1998) identified six general motivational categories that could lead Wikipedians to contribute to the encyclopedia (Nov, 2007). These are: protective ("By writing/editing in Wikipedia I feel less lonely."), values ("I feel it is important to help others."), career ("I can make new contacts that might help my business or career"), social ("People I'm close to want me to write/edit in Wikipedia"), understanding ("Writing/editing in Wikipedia allows me to gain a new perspective on things"), and enhancement. Nov added two additions, fun ("Writing/editing in Wikipedia is fun") and ideology ("I think information should be free").

Nov noted that the "Fun motivation is a case where there is both high ranking of the motivation and a strong, significant correlation between motivation and contribution levels and therefore it would make sense for organizers of user-generated content outlets to focus marketing, recruitment, and retention efforts by highlighting the fun aspects of contributing" (Nov 2007, 64). Ideology, on the other hand, is a case where high ranking is not coupled by a strong correlation with the contribution level.

Writing Challenges appeal to most of the general motivational categories listed above. Beyond the "protective", "values", and "understanding" categories, it provides the arguments to gain a new perspective on contributing as a motivational context is often provided in the introduction to the contest. It also provides fun and social stimulation with teams, points, and winners, and it facilitates recognition and, potentially, to careers through the rewards offered to the winners, such as winning barnstars (Wikipedia medals of merit) that are displayed on user pages.

Writing challenges does not often involve the creation of hard core content from scratch, but rather fosters an easier production process, such as 1) the creation of very short articles that have well defined structures (such as biographies), 2) the creation of an article through the translation of other linguistic versions (a process that is facilitated by a translation tool), or 3) to foster a copyediting process and formatting process that transforms a very poor article into a short but properly formatted and well-sourced article (the "destubing" process).

However, it should be pointed out that writing challenges mostly rely on existing active wikipedians rather than new editors and are rarely designed to accommodate newcomers. Though efficient, this methodology should be used with great care as it could lead to overly relying on the same wikipedians and forgetting the outsiders who provide the core of the content. As Aaron Swartz (2006) explained: "an outsider makes one edit to add a chunk of information, then insiders make several edits tweaking and reformatting it. (...) As a result, insiders account for the vast majority of the edits. But it's the outsiders who provide nearly all of the content. Instead of trying to squeeze more work out of those who spend their life on Wikipedia, we need to broaden the base of those who contribute just a little

bit. Unfortunately, precisely because such people are only occasional contributors, their opinions aren't heard by the current Wikipedia process. Out of sight is out of mind, so it's a short hop to thinking these invisible people aren't particularly important" (Swartz 2006, nd).

6.3. Inviting experts to contribute was a fairly successful strategy to make new content available on Wikipedia or for Wikipedia or to trigger contributions by the Wikipedia community.

The results of the research suggests that publishing an external expert review actually has a beneficial impact. This is either because the review is actually used to improve the article, or because the process brings attention to the article itself.

A careful look at the articles that have not been improved at all indicate that most of those are highly specialised South Africa-related articles (such as *san healing practices* or *water supply and sanitation in South Africa*) and are probably not perceived to be impactful articles by non-South African editors, and difficult to improve by a layman within the context of limited South African editorship.

It should be noted that the process of seeking external expert review did not raise any negative feedback from the community. At worse, it didn't get any comment at all. At best, it got enthusiastic comments and the expert reviews were actually used to improve the articles.

- Further conclusions on the success factors of involving experts are the following:
  With regards to academic experts motivations, we noted that a direct contact with the potential expert via a recommendation from an academic colleague was the most successful strategy by far to get agreement from that expert to provide a review. The schedule of the request was a major factor in the rate of acceptance, so this strategy should be fine-tuned to identify the best moment to send inquiries to experts.

- A special unfavorable note should be made about the highly bureaucratic OTRS system that is used to record free licence contributions by experts. It was very cumbersome, time consuming, needlessly paranoid – given the nature of the contribution (a review of an existing Wikipedia article) – and the documentation process. Worst of all, the rules appeared to change each time, and depended on which OTRS agent you were engaged in. In short, the OTRS process was potentially a motivation killer and any future process involving the review of experts being contributed in this way should anticipate these difficulties.

6.4. The failing strategy of involving scientific journals to improve Wikipedia articles by sharing their content and/or bibliography

The invitation to scientific journals to contribute to Wikipedia with their expertise was aimed at triggering content production. In our experience, it did not get to the critical stage in the negotiations where content was actually proposed.

Different strategies to to contribute to the improvement of Wikipedia articles were proposed. These strategies ranged from content creation, and content review, to sharing bibliographic references, and required different degree of engagement and participation, but despite that, none were accepted.

In addition, even the selection of open access journals that are already producing contents on African topics or published in African Countries, which were assumed to be more sensible to the open access movement, did not produce results.

Researchers have previously demonstrated the benefit of bridging academic knowledge and Wikipedia for both systems (Fuchs and Sandoval 2013). Despite this, there is a widespread notion that the future success of academia and for-profit academic publishing is challenged by the open access model (Naughton 2012; Tennant *et al.* 2016; Siler 2017).

Up to now only two others initiatives (the PLOS experience[52] and the Wiki Journal of Medicine[53]) have attempted to implement experiments that are aimed at bridging the gap between academia and Wikipedia. These initiatives had adopted two different approaches to publishing content (Shafee *et al.* 2016) , using in one case the journal PLOS as the main content interface (model: journal first) and in the other Wikipedia as the main publishing platform (model: Wikipedia first). If, on one side, the results of their experiments are interesting in terms of content quality and a well-structured peer-review process, on the other side, these experiments also did not result in an astonishing number of new articles. Since 2012, 10 new topic articles have been published on PLOS (an average of 2 per year) and 25 on the Wiki Journal of Medicine. Despite these cases studies, and the concentration on subjects (Science and Medicine) that are highly consulted on Wikipedia , it seems that the significant effort invested in involving the academic community on Wikipedia has not really been compensated by actual results. The reason of these difficulties can be found in the widespread monopoly of academic knowledge by scientific journals.

The reticence of scientific journals in contributing to Wikipedia appears to be related to the fact that an important part of their work and activity is about building a network of reviewers. This reviewers' network is an important asset for each journal and influences their overall quality and value. This is an asset that is deemed too important to share. A network of good quality scholars and researchers available to work for free does not happen automatically. It requires significant effort: establishing, feeding and maintaining personal relationships that are based on mutual trust and respect. This is especially difficult as the recognition of each reviewer's input is usually minimal in the process of publishing scientific content. Our recent experience (gained through directly addressing academic reviewers) teaches us that only 15% of the experts are actually available to complete the work - and this can often only be done if the deadlines are pushed beyond the initial deadlines. Setting up a community of reviewers is a process that requires, in itself, time, patience and endless engagement.

In contrast to the experiences of the PLOS and Wiki Journal of Medicine, this project tested an additional strategy that invited the editors of journals to share their own bibliographic references, with the intent of improving the few articles that specifically related to their core topic. The hypothesis we tested was that this strategy would require less effort and work by the journal staff. It would also provide wider visibility and an increased reputation for the journal, without threatening or diluting its assets.Journal credits would have been properly cited and suggested on Wikipedia's articles talk page and bibliography. At the same time this strategy would have meant a higher involvement of the Wikipedia community that would have to read, re-elaborate and edit content according to Wikipedia's rules. Even in this case, the strategy, tested on 14 journals, was not successful.

From these experiences, we can argue that scientific journals are not yet ready to envision the benefits of the open access model and evolve their practices accordingly. They are not ready for social innovation and the challenge of sharing free knowledge in exchange for increased reputation.

[52] http://collections.plos.org/topic-pages
[53] https://en.wikiversity.org/wiki/WikiJournal_of_Medicine

However, future research in this direction could be developed in order to:

- test the strategy of sharing bibliographic references though scientific conferences and academic meeting, as a practice parallel to that of sharing abstracts. This would require important work towards the coordination and classification of scientific articles in relation to Wikipedia articles and topic, and
- involve the readership of Wikipedia as relevant stakeholders to involve in the process of article improvement.

7. Conclusions and further developments

There is a problem of imbalance with regards to access to knowledge within the world ... the concept of access is a conceptual shorthand that comprises knowledge creation, access, distribution, sharing, use, reuse, adaptation of human knowledge, including multiples and alternative perspectives, knowledge-embedded goods and tools for the production of knowledge and/or information, such as ICTs and the internet (Rizk 2010). Since 2004 the concept of "access to knowledge" has also become a movement, and broadly related to the concept of justice and governance.

The Wikipedia Primary School Research Project attempt to answer three main questions:

1. What are the best strategies for improving Wikipedia content about local topics (in Africa)?
2. How can content relevant to education at primary schools be improved on Wikipedia?
3. How can the scientific community take part in this improvement process and collaborate with the Wikipedia community to attain the goals of primary school educational?

The research presents a set of methodologies that we tested over the course of 48 months to improve at least 100 existing Wikipedia articles that cover topics considered notable both by the scientific and Wikipedia communities. Key outcomes indicate that:

1. common strategies used by the Wikipedia community to trigger article improvement had very little impact,
2. with the exception of writing challenges that appear to be the best bet for triggering volunteer participation,
3. involving experts' contribution was a fairly successful strategy to make new content available on Wikipedia or for Wikipedia or to trigger contributions by the Wikipedia community, and
4. last, we point to the failing strategy of involving scientific journals to improve Wikipedia articles by sharing their content and/or bibliography.

In the same way that natural history museums in 19th Century America represented an important stage in the professionalisation of natural history work, Wikipedia represents a changing relationship between amateurs and professionals in the classification and documentation of 21st Century knowledge. Although Wikipedians are commonly thought of as non-credentialed amateurs, they are engaged in boundary work that establishes themselves as experts in the logics, vocabularies and policies necessary to be successful curators of encyclopedic articles on the platform.

University academics have typically lacked the knowledge required to translate their expert knowledge of subjects to Wikipedia's complex rules. Wikipedia has an epistemic culture that is distinct from academia and has resulted in significant rifts between the two networks. Academics realise that they need to contribute to Wikipedia as it grows in authority, but they lack the understanding of Wikipedia's policies, epistemologies, practices and norms in order to do so. Being a

successful Wikipedia contributor requires being part of its community of practice. This can only be achievable through long hours spent engaging with others as an editor and building up one's Wikipedian reputation that is largely separate from one's professional identity.

Instead of individualistic notions of incentives that have been used to explain the success and failure of particular interventions aimed at growing Wikipedia's edit base, we suggest that strategies that involve negotiation between different expert groups are key to understanding why some interventions succeed or fail. We will continue to see a trickle of bridge-builders working in both worlds where individuals see themselves as legitimate members of both the academic and Wikipedia communities, but they are likely to remain anomalies. It is essential to explore and find methods for translating authoritative credentials, respecting and recognising work practices, and developing flexible mechanisms for communication between these different communities of practice.

The peer production model on its own does not produce public goods that are representative of everyone's knowledge, and interventions are required to stimulate the development of underrepresented topics. This case study demonstrates the importance of aligning the work practices of knowledge workers outside of Wikipedia when trying to stimulate the development of targeted content. Further work to refine the expert review, and the communication processes that support it, are essential to understanding how Wikipedia reflects contemporary knowledge work and for how it could be used to develop a more equitable, diverse representation of the world knowledges.

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9. Appendixes

9.1. Terminology

WikiProject:
A WikiProject is the on-wiki way of organising a group of people who want to work as a team to improve a specific theme or subject on Wikipedia.
https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Council/Guide/WikiProject.

OTRS (Open Source Ticket Request System) software is used to handle queries, complaints, statements, and comments from the public by email to Wikimedia projects. It was set up in September 2004. Sometimes Wikimedians want confirmation that the copyright holder of images or text uploaded to Wikipedia or Wikimedia Commons has agreed to the license shown on the project.

This is traditionally done asking by the copyright holder to email a licence release confirmation (templates are available), and storing that record into the OTRS system. Volunteers trusted to give courteous, helpful, and accurate responses are given access to the system via the web at https://ticket.wikimedia.org/.

https://commons.wikimedia.org/wiki/Commons:OTRS

9.2. List of all Wikipedia Primary School articles

Topic	More specific topic from the South African curriculum	List of articles proposed	Direct link to Wikipedia
National history	General	Republic of South Africa	https://en.wikipedia.org/wiki/Republic_of_South_Africa
National history	History of South Africa	History of South Africa	https://en.wikipedia.org/wiki/History_of_South_Africa
National history	Flag of SA	Flag of South Africa	https://en.wikipedia.org/wiki/Flag_of_South_Africa
National history	Anthem of SA	National anthem of South Africa	https://en.wikipedia.org/wiki/National_anthem_of_South_Africa
National history	National symbols	National symbols of South Africa	https://en.wikipedia.org/wiki/National_symbols_of_South_Africa
National history	Constitutional Hill	Constitutional Hill	https://en.wikipedia.org/wiki/Constitution_Hill,_Johannesburg
National history	Constitutional Court	Constitutional Court of South Africa	https://en.wikipedia.org/wiki/Constitutional_Court_of_South_Africa
Life stories of leaders	Nelson Mandela (mentioned in the CAPS)	Nelson Mandela	https://en.wikipedia.org/wiki/Nelson_Mandela
Life stories of leaders	Mahatma Gandhi (mentioned in the CAPS)	Mahatma Gandhi	https://en.wikipedia.org/wiki/Mahatma_Gandhi
Life stories of leaders	Walter Sisulu	Walter Sisulu	https://en.wikipedia.org/wiki/Walter_Sisulu
Life stories of leaders	Oliver Tambo	Oliver Tambo	https://en.wikipedia.org/wiki/Oliver_Tambo
Life stories of leaders	Winnie Mandela	Winnie Mandela	https://en.wikipedia.org/wiki/Winnie_Madikizela-Mandela
Life stories of leaders	Steve Biko	Steve Biko	https://en.wikipedia.org/wiki/Steve_Biko

Transport on land	Animals	Animal powered transport	https://en.wikipedia.org/wiki/Animal-powered_transport
Transport on land	Carts, wagons, coaches	Transport in South Africa	https://en.wikipedia.org/wiki/Transport_in_South_Africa
Transport on land	Bicycle	Bicycle	https://en.wikipedia.org/wiki/Bicycle
Transport on land	Steam engine and train	Rail transport	https://en.wikipedia.org/wiki/Rail_transport
Transport on land	Steam engine and train	Rail transport in South Africa	https://en.wikipedia.org/wiki/Rail_transport_in_South_Africa
Transport on land	Motor car	Automobile	https://en.wikipedia.org/wiki/Automobile
Transport on land	Common forms of transport of people and goods today	Transport	https://en.wikipedia.org/wiki/Transport
Transport on land	Steam engine and train	South African Locomotive history	https://en.wikipedia.org/wiki/South_African_locomotive_history
Transport on land	Steam engine and train	Tow foot gauge railways in South Africa	https://en.wikipedia.org/wiki/Two_foot_gauge_railways_in_South_Africa
San hunter-gatherer society in the Later Stone Age	(all about them)	Later Stone Age	https://en.wikipedia.org/wiki/Later_Stone_Age
San hunter-gatherer society in the Later Stone Age	(all about them)	San people	https://en.wikipedia.org/wiki/San_people
San hunter-gatherer society in the Later Stone Age	(all about them)	!Kung People	https://en.wikipedia.org/wiki/%C7%83Kung_people
San hunter-gatherer society in the Later Stone Age	(all about them)	San Religion	https://en.wikipedia.org/wiki/San_religion
San hunter-gatherer society in the Later Stone Age		Gana and Gwi people	https://en.wikipedia.org/wiki/Gana_and_Gwi_people
San hunter-gatherer society in the Later Stone Age		San Languages	https://en.wikipedia.org/wiki/San_languages
Khoikhoi herder society in the Later Stone Age	(all about them)	Khoikhoi	https://en.wikipedia.org/wiki/Khoikhoi
Khoikhoi herder society in the Later Stone Age	(all about them)	Griqua people	https://en.wikipedia.org/wiki/Griqua_people
Khoikhoi herder society in the Later Stone Age	(all about them)	Herero and Namaqua Genocide	https://en.wikipedia.org/wiki/Herero_and_Namaqua_Genocide
Khoikhoi herder society in the Later Stone Age	(all about them)	Khoikhoi mythology	https://en.wikipedia.org/wiki/Khoikhoi_mythology
Khoikhoi herder society in the Later Stone Age	(all about them)	Hottentot Venus	https://en.wikipedia.org/wiki/Hottentot_Venus
Heritage from each province	Cradle of humankind - Gauteng	Cradle of Humankind	https://en.wikipedia.org/wiki/Cradle_of_Humankind
Heritage from each province	Cradle of humankind - Gauteng	Gauteng	https://en.wikipedia.org/wiki/Gauteng
Heritage from each province	Golden objects at Mapungubwe - Limpopo	Mapungubwe	https://en.wikipedia.org/wiki/Mapungubwe
Heritage from each province	Golden objects at Mapungubwe - Limpopo	Mapungubwe National Park	https://en.wikipedia.org/wiki/Mapungubwe_National_Park

Heritage from each province	Golden objects at Mapungubwe - Limpopo	Mapungubwe Museum	https://en.wikipedia.org/wiki/Mapungubwe_Museum
Heritage from each province	Frances Baard - Northern Cape	Frances Baard	https://en.wikipedia.org/wiki/Frances_Baard
Heritage from each province	Heritage in names of rivers, dams, towns - Free State	Free State province	https://en.wikipedia.org/wiki/Free_State_%28province%29
Heritage from each province	Changing identities, the Castle - Western Cape	Western Cape	https://en.wikipedia.org/wiki/Western_Cape
Heritage from each province	Changing identities, the Castle - Western Cape	Castle of Good Hope	https://en.wikipedia.org/wiki/Castle_of_Good_Hope
Heritage from each province	Healing properties of the Aloe - Eastern Cape	Aloe	https://en.wikipedia.org/wiki/Aloe#Uses
Heritage from each province	Healing properties of the Aloe - Eastern Cape	Aloe vera	https://en.wikipedia.org/wiki/Aloe_vera#Uses
Heritage from each province	Stone-walled town of Kaditshwene - North West	Kaditshwene	https://en.wikipedia.org/wiki/Kaditshwene
Heritage from each province	Indigenous Knowledge Systems	Mpumalanga	https://en.wikipedia.org/wiki/Mpumalanga
Heritage from each province	San rock art in the Drakensberg - Kwazulu Natal	San rock art	https://en.wikipedia.org/wiki/San_rock_art
Heritage from each province	San rock art in the Drakensberg - Kwazulu Natal	Drakensberg	https://en.wikipedia.org/wiki/Drakensberg#San_cave_paintings
Heritage from each province	Indigenous Knowledge Systems	Makhonjwa Mountains	https://en.wikipedia.org/wiki/Makhonjwa_Mountains
Crop and stock farming	Important crops in South Africa	Agriculture in South Africa	https://en.wikipedia.org/wiki/Agriculture_in_South_Africa
Crop and stock farming	Case study of fruit farming in South Africa	Farm	https://en.wikipedia.org/wiki/Farm
Food processing	Cooking	South African Cuisine	https://en.wikipedia.org/wiki/South_African_cuisine
Food processing	(Food preparation)	Cooking	https://en.wikipedia.org/wiki/Cooking
How people get access to water	Collecting water from rivers, streams, springs	Water supply and sanitation in SA	https://en.wikipedia.org/wiki/Water_supply_and_sanitation_in_South_Africa
How people get access to water	Collecting water from rivers, streams, springs	Water privatization in SA	https://en.wikipedia.org/wiki/Water_privatization_in_South_Africa
How people get access to water	Boreholes and wells	Borehole	https://en.wikipedia.org/wiki/Borehole
How people get access to water	Boreholes and wells	Water well	https://en.wikipedia.org/wiki/Water_well
How people get access to water	Taps (how they work)	Tap valve	https://en.wikipedia.org/wiki/Tap_%28valve%29#Water_taps
Mineral and coal resources in South Africa	How coal is formed. Use of coal	Coal	https://en.wikipedia.org/wiki/Coal
Mineral and coal resources in South Africa	Location of mineral and coal mines and links to settlement patterns (map)	Mining industry of SA	https://en.wikipedia.org/wiki/Mining_industry_of_South_Africa

Mineral and coal resources in South Africa	Location of mineral and coal mines and links to settlement patterns (map)	Coal in SA	https://en.wikipedia.org/wiki/Coal_in_South_Africa
Fair trading	Concepts and definitions	Fair trade	https://en.wikipedia.org/wiki/Fair_trade#Africa
Fair trading	Trading	Trade	https://en.wikipedia.org/wiki/Trade
Animal shelters	Case study of animal shelters	Bird nest	https://en.wikipedia.org/wiki/Bird_nest
Animal shelters	Case study of animal shelters	Nest	https://en.wikipedia.org/wiki/Nest#Names_of_nests
Solid materials	Sand and glass	Sand	https://en.wikipedia.org/wiki/Sand
Solid materials	Sand and glass	Glass	https://en.wikipedia.org/wiki/Glass
Solid materials	Fibers and paper	Fiber	https://en.wikipedia.org/wiki/Fiber
Solid materials	Fibers and paper	Paper	https://en.wikipedia.org/wiki/Paper
Solid materials	Clay and ceramics	Clay	https://en.wikipedia.org/wiki/Clay
Solid materials	Clay and ceramics	Ceramic	https://en.wikipedia.org/wiki/Ceramic
Solid materials	Wool and fabric	Wool	https://en.wikipedia.org/wiki/Wool
Solid materials	Wool and fabric	Fabric	https://en.wikipedia.org/wiki/Textile
Movement and energy in a system	Indigenous musical instruments	African musical instruments	https://en.wikipedia.org/wiki/African_music#Musical_instruments
Movement and energy in a system	How instruments work and are designed (any instrument)	Music of South Africa	https://en.wikipedia.org/wiki/Music_of_South_Africa
Vibration and sound	Vibration and sound	Vibration	https://en.wikipedia.org/wiki/Vibration
Vibration and sound	Vibration and sound	Sound	https://en.wikipedia.org/wiki/Sound
Vibration and sound	Making sounds (volume, pitch, duration)	Pitch in music	https://en.wikipedia.org/wiki/Pitch_%28music%29
Vibration and sound	Making sounds (volume, pitch, duration)	Duration in music	https://en.wikipedia.org/wiki/Duration_%28music%29
Vibration and sound	Noise pollution	Noise pollution	https://en.wikipedia.org/wiki/Noise_pollution
Stored energy in fuels	Fuels: wood, coal, petrol paraffin, gas, wax (and also food)	Energy in South Africa	https://en.wikipedia.org/wiki/Energy_in_South_Africa
Stored energy in fuels	Fuels: wood, coal, petrol paraffin, gas, wax (and also food)	Wood	https://en.wikipedia.org/wiki/Wood
Stored energy in fuels	Fuels: wood, coal, petrol paraffin, gas, wax (and also food)	Petrol paraffin engine	https://en.wikipedia.org/wiki/Petrol-paraffin_engine
Stored energy in fuels	Fuels: wood, coal, petrol paraffin, gas, wax (and also food)	Gaz	https://en.wikipedia.org/wiki/Gas
Stored energy in fuels	Fuels: wood, coal, petrol paraffin, gas, wax (and also food)	Wax	https://en.wikipedia.org/wiki/Wax
Stored energy in fuels	Fuels: wood, coal, petrol paraffin, gas, wax (and also food)	Food versus fuel	https://en.wikipedia.org/wiki/Food_vs._fuel
Stored energy in fuels	Burning fuels	Liquid fuel	https://en.wikipedia.org/wiki/Liquid_fuel
Stored energy in fuels	Safety with fire	Fire safety	https://en.wikipedia.org/wiki/Fire_safety

Nutrients in food / Balanced diets	Food groups	Food groups	https://en.wikipedia.org/wiki/Food_groups
Nutrients in food / Balanced diets	Natural foods and mixtures of food groups	Food	https://en.wikipedia.org/wiki/Food
Nutrients in food / Balanced diets	Processed foods	Convenience food	https://en.wikipedia.org/wiki/Processed_food
Nutrients in food / Balanced diets	Concept of balanced diet Diet and diseases	Human nutrition	https://en.wikipedia.org/wiki/Human_nutrition
Ecosystem, natural resources	Water pollution	Water pollution	https://en.wikipedia.org/wiki/Water_pollution
Ecosystem, natural resources	Wetlands	wetlands	https://en.wikipedia.org/wiki/Wetlands
Ecosystem, natural resources	Pollution	Pollution	https://en.wikipedia.org/wiki/Pollution
Ecosystem, natural resources	Climate	Climate	https://en.wikipedia.org/wiki/Climate
Ecosystem, natural resources	Biomes	Biome	https://en.wikipedia.org/wiki/Biome
Ecosystem, natural resources	Rocks	Rock (geology)	https://en.wikipedia.org/wiki/Rock_(geology)
Ecosystem, natural resources	Soil	Soil	https://en.wikipedia.org/wiki/Soil
Ecosystem, natural resources	Ecosystems	Ecosystem	https://en.wikipedia.org/wiki/Ecosystem
Biosphere reserves	Ecosystems	Kogelberg Nature Reserve	https://en.wikipedia.org/wiki/Kogelberg_Nature_Reserve
Biosphere reserves	Ecosystems	West Coast National Park	https://en.wikipedia.org/wiki/West_Coast_National_Park
Biosphere reserves	Ecosystems	Waterberg Biosphere	https://en.wikipedia.org/wiki/Waterberg_Biosphere
Biosphere reserves	Ecosystems	Kruger to Canyons Biosphere	https://en.wikipedia.org/wiki/Kruger_to_Canyons_Biosphere
Biosphere reserves	Ecosystems	Gouritz Cluster Biosphere Reserve	https://en.wikipedia.org/wiki/Gouritz_Cluster_Biosphere_Reserve
Biosphere reserves	Ecosystems	Magaliesberg Biosphere Reserve	https://en.wikipedia.org/wiki/Magaliesberg_Biosphere_Reserve
Processes to purify water	Sieving	Sieving	https://en.wikipedia.org/wiki/Sieving
Processes to purify water	Filtering	Water filter	https://en.wikipedia.org/wiki/Water_filter
Processes to purify water	Settling	Settling	https://en.wikipedia.org/wiki/Settling
Processes to purify water	Decanting	Decanting	https://en.wikipedia.org/wiki/Decanting
Processes to purify water	Boiling	Boiling	https://en.wikipedia.org/wiki/Boiling
Bullying	What is bullying	Bullying	https://en.wikipedia.org/wiki/Bullying
HIV/AIDS	* Basic explanation * Transmission through blood * How it is not transmitted * Protection	HIV	https://en.wikipedia.org/wiki/HIV
HIV/AIDS	* Basic explanation * Transmission through blood * How it is not transmitted * Protection	AIDS	https://en.wikipedia.org/wiki/HIV/AIDS

HIV/AIDS	AIDS orphans and single parents	AIDS orphan	https://en.wikipedia.org/wiki/AIDS_orphan
HIV/AIDS	Health care in South Africa	Health care in South Africa	https://en.wikipedia.org/wiki/Health_care_in_South_Africa
Discrimination, stereotypes and bias	Discrimination	Discrimination	https://en.wikipedia.org/wiki/Discrimination
Discrimination, stereotypes and bias	Stereotypes	Stereotypes	https://en.wikipedia.org/wiki/Stereotype
Discrimination, stereotypes and bias	Bias	Bias	https://en.wikipedia.org/wiki/Bias
Discrimination, stereotypes and bias	Bill of Rights	Bill of Rights	https://en.wikipedia.org/wiki/Bill_of_Rights_%28South_Africa%29
Discrimination, stereotypes and bias	Children's Act (SA)	Children's Act (SA)	https://en.wikipedia.org/wiki/Children%27s_Act_%28South_Africa%29
Discrimination, stereotypes and bias	Apartheid	Apartheid	https://en.wikipedia.org/wiki/Apartheid
Child abuse	Forms of child abuse (physical/emotional)	Child abuse	https://en.wikipedia.org/wiki/Child_abuse
Safety measures	Harmful house products and medication	Home safety	https://en.wikipedia.org/wiki/Home_safety
Gender stereotyping	Gender stereotyping	Gender role	https://en.wikipedia.org/wiki/Gender_role#Gender_stereotypes
Gender stereotyping	Sexism	Sexism	https://en.wikipedia.org/wiki/Sexism
National events	Human Rights day	Human rights day	https://en.wikipedia.org/wiki/Human_Rights_Day
National events	Freedom day	Freedom day in SA	https://en.wikipedia.org/wiki/Freedom_Day_%28South_Africa%29
National events	Heritage day	Heritage day in SA	https://en.wikipedia.org/wiki/Heritage_Day_%28South_Africa%29
National events	Reconciliation day	Reconciliation day	https://en.wikipedia.org/wiki/Reconciliation_Day
National events	Children's day	Children's day	https://en.wikipedia.org/wiki/Children%27s_Day#South_Africa
National events	Women's day	National Women Day	https://en.wikipedia.org/wiki/National_Women%27s_Day
National events	Africa day	Africa Day	https://en.wikipedia.org/wiki/Africa_Day
National events	Mandela day	Mandela Day	https://en.wikipedia.org/wiki/Mandela_Day
Circuits	Circuits	Electrical network	https://en.wikipedia.org/wiki/Electrical_network
Circuits	Conductors	Electrical conductor	https://en.wikipedia.org/wiki/Electrical_conductor
Circuits	Insulators	Insulator	https://en.wikipedia.org/wiki/Insulator_%28electricity%29
Circuits	Circuit diagrams	Circuit diagram	https://en.wikipedia.org/wiki/Circuit_diagram
Circuits	Sources of electricity	Electricity generation	https://en.wikipedia.org/wiki/Electricity_generation
Animal husbandry and wild animal maintenance		Animal husbandry	https://en.wikipedia.org/wiki/Animal_husbandry
Animal husbandry and wild animal maintenance		Wildlife management	https://en.wikipedia.org/wiki/Wildlife_management
Animal husbandry and wild animal maintenance		Wildlife conservation	https://en.wikipedia.org/wiki/Wildlife_conservation
Alcoholism		Alcoholism	https://en.wikipedia.org/wiki/Alcoholism
Alcoholism		Alcohol dependence	https://en.wikipedia.org/wiki/Alcohol_dependence
Alcoholism		Alcohol abuse	https://en.wikipedia.org/wiki/Alcohol_abuse
Domestic violence		Outline of domestic violence	https://en.wikipedia.org/wiki/Outline_of_domestic_violence
Domestic violence		domestic violence in South Africa	https://en.wikipedia.org/wiki/Domestic_violence_in_South_Africa
Domestic violence		domestic violence	https://en.wikipedia.org/wiki/Domestic_violence

Health and hygiene topics and impacts	Hand washing	hand washing	https://en.wikipedia.org/wiki/Hand_washing
Health and hygiene topics and impacts		Malaria	https://en.wikipedia.org/wiki/Malaria
Health and hygiene topics and impacts		Human swimming	https://en.wikipedia.org/wiki/Human_swimming
Health and hygiene topics and impacts		Food pyramid (nutrition)	https://en.wikipedia.org/wiki/Food_pyramid_(nutrition)
Health and hygiene topics and impacts	Healthy body	Health	https://en.wikipedia.org/wiki/Health
Health and hygiene topics and impacts		San healing practices	https://en.wikipedia.org/wiki/San_healing_practices
Youth culture		Youth culture	https://en.wikipedia.org/wiki/Youth_culture
Gangster		Gangster	https://en.wikipedia.org/wiki/Gangster
Gangster		People Against Gangsterism and Drugs	https://en.wikipedia.org/wiki/People_Against_Gangsterism_and_Drugs
Economy - political system		Economy of SA	https://en.wikipedia.org/wiki/Economy_of_South_Africa
Economy - political system		Politics of SA	https://en.wikipedia.org/wiki/Politics_of_South_Africa
Economy - political system	Notable South Africans	List of South Africans	https://en.wikipedia.org/wiki/List_of_South_Africans
Human rights		Food security	https://en.wikipedia.org/wiki/Food_security
Human rights		Right to food	https://en.wikipedia.org/wiki/Right_to_food
Geography		Latitude	https://en.wikipedia.org/wiki/Latitude
Geography		Longitude	https://en.wikipedia.org/wiki/Longitude
Geography	Basic of a good map	Map	https://en.wikipedia.org/wiki/Map
Geography		Scale (map)	https://en.wikipedia.org/wiki/Scale_(map)
Geography	Street maps	Road map	https://en.wikipedia.org/wiki/Road_map
Mathematics		Control variable	https://en.wikipedia.org/wiki/Control_variable
Mathematics		Dependent and independent variables	https://en.wikipedia.org/wiki/Dependent_and_independent_variables
Mathematics		Standard Model	https://en.wikipedia.org/wiki/Standard_Model
Physics and engineering		Mind map	https://en.wikipedia.org/wiki/Mind_map
Physics and engineering		Outer space	https://en.wikipedia.org/wiki/Outer_space
Physics and engineering		Atom	https://en.wikipedia.org/wiki/Atom
Physics and engineering		Hydraulics	https://en.wikipedia.org/wiki/Hydraulics
Physics and engineering		Pneumatics	https://en.wikipedia.org/wiki/Pneumatics
Biological sciences		Scientific method	https://en.wikipedia.org/wiki/Scientific_method
Biological sciences		Cell (biology)	https://en.wikipedia.org/wiki/Cell_(biology)
Biological sciences	Reproduction in animals and plants	Reproduction	https://en.wikipedia.org/wiki/Reproduction
Biological sciences		Acid	https://en.wikipedia.org/wiki/Acid
Biological sciences		Base (chemistry)	https://en.wikipedia.org/wiki/Base_(chemistry)
History of written communication		History of writing	https://en.wikipedia.org/wiki/History_of_writing

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