

# Wikipedia uses in learning design: A literature review

Georgios Fessakis, Maria Zoumpatianou  
gfesakis@aegean.gr, psempv09005@aegean.gr

Department of Preschool Education and Educational Design, University of the Aegean, Greece

**Abstract.** This paper is a literature review report concerning educational uses of Wikipedia in the first 10 years of its existence. The aim of the work is the tracing and the presentation of published and validated educational applications of Wikipedia in a manner that could inform learning design by teachers or researchers. For the review, 24 scientific publications, retrieved from research databases and concerning educational applications of Wikipedia were analyzed. The review reveals a variety of learning uses of Wikipedia in several contexts, knowledge fields, education level and students' ages. In addition, the study shows a variety of expected learning outcomes and a pleiad of student tasks in the learning activities. Both, the learning outcomes and the students' tasks are organized in general types with the aim of constituting patterns for new learning designs. The findings are commented and possible future directions of research are described.

**Keywords:** Wikipedia, wikis, collaborative writing, learning design

## Introduction

During the last few years, the educational community (of practice and research) has shown interest in a set of relatively new, internet applications known as web 2.0 services (Fessakis et al., 2008). Wikipedia constitutes a special case of a web 2.0 application. It is considered as one of the most successful and widely known applications of wiki technology and an unprecedented example of collaborative writing in human history. The English version of Wikipedia started in 2001 and comprises currently more than 4 millions articles. The reason why this work focuses on Wikipedia lies in the authors' belief that the combination of wiki technology (e.g. collaborative writing, dynamic information search, version and revision control and management) together with the wealth of the articles of an encyclopedia provide unique opportunities for educational applications, beyond the simple information retrieval option, which is usually the first thought. For the educational applications of wikis, in general, the interested reader is recommended to study more specialized works e.g. Duffy & Bruns (2006) and Konieczny (2007).

The aim of the present literature review is the tracing and study of educational applications of Wikipedia in a manner that would be both utilitarian and inspiring for learning designers. More specifically, the results of the literature review are based on the analysis of the learning interventions found according to the following axes: expected learning outcomes, knowledge fields and subject matters of the application, educational levels and student task types.

The rest of the article is structured as follows: first, a brief comparison between Wikipedia and traditional encyclopedias as well as their role in education are provided; the research methodology and the procedure of search for the sample researches are described next. These are followed by the presentation of the findings and the article concludes with a summary of the findings and a discussion of their implications.

## Encyclopedias and Education

The modern concept for encyclopedia, which is mainly attributed to Denis Diderot, describes a type of reference work that concentrates summary of information for any kind or specific branches of knowledge (Encyclopedia, 2012). Traditional encyclopedias can either be general or thematic and are distributed in printed or digital form. Digital encyclopedias have very small storage demands, contain multimedia information and permit dynamic search for lemmas with the use of keywords. Digital encyclopedias could be either local or accessed through the internet. Prevailing educational exploitations of encyclopedias include their use as an information source and a starting point for study; students are required to retrieve and process information from an encyclopedia in the context of their assignments. Whatever their form (printed or digital), traditional encyclopedias do not allow authoring actions by readers. And this is exactly where the key difference of Wikipedia lies. Wikipedia readers are the main contributing authors. The main features of Wikipedia are presented in the following sections.

## Wikipedia and Education

Wikipedia was launched in January 2001 by Jimmy Wales and Larry Sanger. The name Wikipedia, given by Sanger, is a portmanteau of wiki and encyclopedia (Wikipedia, 2012). Wikipedia is considered one of the most successful and unprecedented internet applications of the "Web 2.0" category in which the users can easily contribute content as in other well known services e.g. YouTube and Facebook. According to the site's statistics, Wikipedia contains articles in more than 280 languages. The wide spread of Wikipedia could be attributed mainly in its fundamental advantages: easy and free accessibility, frequent update, publication of recent-current information and fast control of the updates by Wikipedia's active community.

Any Wikipedia's reader is able to edit an existing article just by clicking on the "Edit" link on the article's page menu. The "guide for new users" and other tools provided by Wikipedia helps the inexperienced users to contribute content that is consistent to the encyclopedia's policy and rules. In addition, with the help of "talk" feature, the user is able to see and participate in the dialogue that other authors/readers are developing around a specific article. Finally, the "View history" feature makes it possible for the user to trace all revisions of an article and to analyze the authors' contributions to its current version.

The Wikipedia's advantages in comparison to any other simple wiki service for educational applications are mainly the ever growing volume of available information, the links, the images, the complete articles and the large and active community of users which provide students with opportunities and reasons to interact with each other and/or with Wikipedia's other users. While using Wikipedia, a student is likely to receive feedback not only from the members of her/his educational community but also from a wider group of people.

In order to facilitate and foster educational applications, Wikipedia has officially manifested interest in its educational uses by launching the "School and University Project" (SUP) (Konieczny, 2007:25). In addition, several scholars and educators are independently producing learning interventions enhanced with Wikipedia uses. The expansion of Wikipedia's applications to a range of learning activities and in fact, its unique features (as a collaborative authoring medium) regarding its exploitation in the learning process, is of significant interest to the educational community. Wikipedia gives teachers and students unprecedented opportunities for learning, in comparison with traditional encyclopedias.

The impact of these opportunities in the learning design -as documented in scientific publications- is explored in this paper.

## Research rationale and methodology

From the learning-design perspective it is interesting to search for general patterns and features in the educational applications of Wikipedia which have been documented in scientific publications during the first decade of its existence. To approach this aim, the literature review method based on tracing and presenting published and validated educational applications of Wikipedia in a way that that brings out new insights to the learning design community, by teachers or researchers, has been adopted.

The term literature review refers to the systematic study and analysis of publications (e.g. articles, books, dissertations etc) containing information that is relevant to a research problem (Gay et al., 2009). A literature review aims to summarize the research finding about an issue up to a specific time point (Gay et al., 2009). The use of the method, within the framework of this paper, serves the purpose of identifying scientific publications that provide detailed descriptions of learning interventions/designs that incorporate Wikipedia uses, with the ultimate goal of coming up with an a posteriori description of the learning design characteristics that could inspire educators and researchers.

Searches in popular research databases e.g. ERIC, Scholar, Scopus, and HAICTE (Greek) with "wikipedia", "classroom" and "education" as keywords yielded 30 works. From the initial set of 30 works, 24 were selected for further study because these include detailed descriptions of the design and/or implementation of the learning activities that make use of Wikipedia. Most of these works (17) concern college and/or university students while there are some for secondary education level and none for lower levels and finally, three works that do not refer explicitly to any specific educational level. The works of the sample are mentioned in the reference section of this article. The sample works were analyzed with regard to the following three axes:

- Expected learning outcomes
- Knowledge field – subject matter
- Student tasks.

## Literature analysis findings

In this section the literature review results for the educational uses of Wikipedia are presented along with each axis of analysis. The section begins with the presentation of the diverse expected learning outcomes of the interventions, continues with a summary of the involved knowledge fields or subject-matters, and ends with a description of the tasks assigned to students.

### *Expected learning outcomes*

Nine general categories of, explicitly stated, expected learning outcomes were found from the described interventions in the works analyzed for the review (Table 1). The categories of learning outcomes are described below beginning with the technology-oriented and continuing to the more general ones.

**Table 1. Categories of learning outcomes**

No	Category	Number of articles
1	Familiarization with wikis and development of digital literacy in general	3
2	Development of information literacy	3
3	Concept exploration and understanding	3
4	Learning of research methodology	9
5	Scientific communication skills development	5
6	Understanding of the historical research methodology	3
7	Foreign language learning	3
8	Critical thinking learning	7
9	Collaboration competency development	3

### **Familiarization with wikis and development of digital literacy in general**

Using Wikipedia is an obvious way to familiarize students with wikis and the administration of the communities that have been developed around it. Furthermore, digital literacy is often a main or secondary learning goal in the proposed educational interventions of the sample works. In addition, Reilly (2011) has proposed the use of Wikipedia as a medium/vehicle for the demonstration of technological concepts and the related terminology. The use of Wikipedia gives students opportunities to develop simple technological skills (e.g. text editing) as well as more advanced competences such as collaborative writing and participation in online communities. McDonald (2007a) as well as Chandler & Gregory (2010), confirm the learning of technological skills developed by students who were engaged in the implementation of learning designs that used Wikipedia.

### **Development of information literacy**

The term information literacy concerns the capability to: i) determine and organize the required information for the solution of a specific problem, ii) find and effectively use the best information sources for specific needs. The term is sometimes confused with "Informatics-technology literacy" or "digital literacy" which refers to the development of the ability to use technological applications. Wikipedia can be utilized for the development of information literacy (Sormunen et al., 2011) through specially designed learning activities e.g. inquiry learning-based case studies, involving information collation etc. Information literacy includes the awareness about trustworthiness of information resources. Students need to learn to check the validity of information and reliability of their resources in general and especially when these are retrieved from the internet. It is a common belief that students often use Wikipedia as information resource for their projects without worrying about the validity issues regarding its content. Specially designed learning activities which document and utilize specific problematic cases have the potential of developing the awareness about the information's validity and reliability. Examples of such learning designs are described in the works of Calkins & Kelley (2009) and Chandler & Gregory (2010).

### **Concept exploration and understanding**

Mainly due to the large volume of its articles but also because of the multiple writers who collaboratively work on the analysis of many concepts from several points of view, Wikipedia is considered ideal for the exploration of concepts. Examples of such works

include Moy et al. (2010) which describes learning interventions for the investigation of chemistry concepts, Callis et al. (2009) concerning the exploration of ecology concepts, and Witzleb (2009) for concepts in the field of Law.

### **Learning of research methodology**

Wikipedia has been used for learning design purposes with the aim of assisting students in developing research methodology skills (Reilly, 2011; Chandler & Gregory, 2010, Nix, 2010; Garvoille & Buckner, 2009; Mc Donald, 2007a). It has also been used for the exercise of research report writing skills (Purdy, 2010). Collaborative writing in Wikipedia is characterized by repetitive revisions of the text, discussions about it, information sharing and division of labor. This process resembles the process of writing a research article. Thus, through their engagement in a research project on Wikipedia, students practice the kind of procedures that the actual researchers need to take in order to collect information and present their ideas (Crovitz & Smoot, 2009). According to Purdy (2009:W364), the use of Wikipedia could offer knowledge to students as well as experience about the knowledge construction process, in other words it could help them to develop their meta-cognitive and scientific research skills. In addition, Wikipedia can teach students how to distinguish between primary and secondary information sources, and to move from a general source (e.g. Wikipedia) to more specific ones (e.g. research report articles in scientific journals). Both skills are considered necessary elements for the learning of the research process (Konieczny, 2007:28).

### **Scientific communication skills development**

Wikipedia constitutes an authentic medium for the communication of scientific issues to a wide audience. As a consequence, some of the sample research works describe learning interventions aiming to develop scientific communication skills (Sormunen et al., 2011; Moy et al., 2010; Witzleb, 2009; Callis et al., 2009). Nix (2010) notes that the use of Wikipedia enforces students to conceptualize the conventions applied in its articles and in extension, helps them to understand the conventions of other text genres. Reliable and sound references characterize and distinguish a scientific article. Through their work on learning projects that use Wikipedia, students are given a chance to get to know the concept of intellectual property and copyright along with the proper ways to write articles that respect the rights of other writers (Chandler & Gregory, 2010). When students know that their articles are accessible to everyone, they are likely to be more mindful of what they write (Chandler & Gregory, 2010).

### **Understanding of the historical research methodology**

Wikipedia, as any other encyclopedia, could be used as an information resource for learning History; teaching methodology of history in an interactive way, with the use of Wikipedia is something unique though which is also not supported by traditional encyclopedias. In the works of Pollard (2008) and Nix (2010), the expected learning outcome of the learning interventions was methodology of History. Students are asked to act as historians and to apply historiography by participating in the development of historical articles related to their subject matter. Students publish their articles about their historical findings and then are encouraged to post and receive comments. The comments of the readers often introduce the students into facts and points of view that they could have hardly thought of, otherwise (Nix, 2010). Furthermore, with its commitment to and support of the Neutral Point of View (NPOV) principle, Wikipedia helps in this direction. According to the NPOV the articles in Wikipedia should be pluralistic and present all the views about the issue of the article. In this way, the authoring for and studying from Wikipedia teaches students the value of objectivity and the collective discussion of issues, which are important for the Historical

methodology. From the “view history” and “talk” links that appear in the Wikipedia environment, users find relative tools which show the evolution of successive versions of the article and the arguments/comments by the users about the article, correspondingly. Rosenzweig (2006) points out that what happens in the discussion tab of Wikipedia, i.e. explanations for contributions and revisions from users, constitutes a case of historiographic debate. Similarly, Hammond et. Al. claim that Wikipedia can be used to introduce students in historical reasoning and epistemology. The uncertain epistemological status of Wikipedia, the wiki structure it uses, and the possibility of a thorough examination of the evolution of articles encourages the epistemological discussions on historical thinking (Hammond et al., 2009).

### **Foreign language learning**

Another category of learning outcomes concerns the learning of foreign languages using Wikipedia (McDonald, 2007a, 2007b; Tardy, 2010). The rich and authentic content of Wikipedia can be utilized in reading assignments as well as in text composition in a foreign language. Furthermore, students are given the opportunity to contrast and compare articles that are -at the same time- available in both, their mother language and in the foreign language they attempt to learn. Finally, it is possible for students to receive linguistic corrections from several users on articles they compose in the foreign language, through the system of continuous revision.

### **Critical thinking learning**

The Wikipedia’s environment is ideal for the development of critical thinking through learning activities involving fruitful debates (contradistinction of views), and/or hypothesis testing, as illustrated in the following sample works: Chanlder & Gregory (2010), Calkins & Kelley (2009), Callis et al. (2009), Cummings (2009), Garvoille & Bucker (2009), and Crovitz & Smoot (2009). Properly designed learning activities regarding the writing and evaluation of Wikipedia's articles can also foster the development of critical thinking (Garvoille & Buckner, 2009).

### **Collaboration competency development**

Some of the educational interventions not only involve collaborative tasks but aim to the development of the collaboration skills, as well. Representative works of this category can be found in: Sormunen et al (2011) and Chandler & Gregory (2010). The learning designs of this category utilize special collaboration scripts that require the use of Wikipedia (Chandler & Gregory, 2010; Sormunen et al., 2011). The collaboration may concern various dimensions of the process, such as, technical issues, choosing information sources for the article and planning the task (Sormunen et al., 2011).

### **Knowledge fields - Subject matters**

The analyzed works contain learning designs in various disciplines such as: History (6), Law (1), Language (3 writing, 3 foreign language learning, 1 literature), Chemistry (1), Ecology (1), Biology (1) and Informatics (2) (Table 2). There are also articles that do not mention specific knowledge field. In summary, we see a variety of knowledge fields from science to humanities with most of the works concerning applications in History and Language. This is interesting because these fields are considered more difficult in terms of ICT integration in their teaching/learning process compared to others e.g. Mathematics, Computer Science. It seems that Wikipedia is attractive to humanities education. It is also significant to note that, since all learning designs that utilize Wikipedia integrate ICT for their implementation, they could as well, be considered interdisciplinary.

**Table 2. Knowledge fields of the applications**

No	Knowledge field	Number of articles
1	History	6
2	Foreign language learning	3
3	Writing	3
4	Biology, Ecology, Chemistry	3
5	Informatics	2
6	Literature	1
7	Law	1

### **Student tasks**

This section presents the students' tasks which involve Wikipedia and were found in the learning interventions of the analyzed works. The kind of tasks assigned to the students reveals the quality of activity and engagement that students experienced during the learning process. Students' tasks are the basic building blocks for the design of teaching and their systematic presentation facilitates their selection during future designs development. The students' tasks found are presented below.

#### **Information search**

The most obvious use of Wikipedia in learning tasks is the search of information and ideas (Purdy, 2010). Wikipedia could also serve as a good starting point for search of references and literature in learning projects (Reilly, 2011; Purdy, 2010:209; Aycock & Aycock, 2008:93) since many articles contain suitable sections titled: "Recommended bibliography", "References", "Further reading", "External links", "See also" etc. Due to the collaborative writing, the issues addressed in the articles may have been analyzed and presented through various perspectives, some of which the students could have hardly imagined at the beginning of their study. (Purdy, 2010:209; Head & Eisenberg, 2010). Finally, Wikipedia has been used to highlight the absence of information on a topic with the ultimate goal of fostering the research and the study on this issue (Moy et al. 2010; Tardy, 2010).

#### **Article composition & editing**

Some researchers (Nix, 2010; Tardy, 2010; Witzleb, 2009; McDonald, 2007b) propose the composition of new articles for Wikipedia. The most significant reason for the authoring of new articles in Wikipedia is to enrich the encyclopedia with new lemmas. The editing of an existing article of Wikipedia can involve several subtasks such as: addition/deletion of content, organization/formatting of content, addition/deletion/update of hyperlinks and syntactic/orthographic revision of articles.

#### **Discussion and dialogue-talk**

Authors often wish to justify their revisions of Wikipedia articles, to exchange views, or simply to read the views of other users. All these needs are fulfilled with the use of the "talk" function in the Wikipedia's environment (Koniczny, 2007). Some works (Crovitz & Smoot, 2009; Cummings, 2009) contain tasks in which students participate in discussion with other users in order to facilitate the emergence of new ideas and views. Finally, because the comments of other users may often trigger revisions of an article, some works ask students to monitor the discussions accompanying specific articles (Nix, 2010; Pollard, 2008).

### **Classification and comparison of articles**

In this kind of task students are asked to classify articles according to certain characteristics (e.g. their theme, articles describing people or events) and to find common patterns (Tardy, 2010). Classification task helps students to understand the encyclopedia's article genre of writing.

### **Article review**

In this type of task students are called to write a review for one or more articles from Wikipedia. Article reviews tasks are included in learning designs in the following works: Tardy (2010), Witzleb (2009), Callis et al. (2009), and McDonald, (2007a).

### **Composition of article about Wikipedia**

Students compare Wikipedia articles to other reference sources; they study articles in terms of reliability of both, Wikipedia and its contributors, as well as of the legal matters for its content. Students also learn about the editing and revision procedures of the articles and finally, they compose an article about the Wikipedia (Calkins & Kelley, 2009: 125). This seems a special purpose task but it has significant learning goals with regard to Information Literacy.

### **Study of the revisions of articles**

In this type of task, students trace and study the revisions of the articles written by themselves (Reilly, 2011; Chandler & Gregory, 2010; Nix, 2010, Cummings, 2009). Students observe, discuss, and write about what happened to their articles after their publication (Nix, 2010). Through their critical analysis of the contributions of other users, students are able to see their articles as a part of a live medium which connects them to a community of active readers (Reilly, 2011).

The above list of tasks reveals a rich variety of options for active student engagement in learning activities that exploit Wikipedia. Most of the tasks are knowledge field independent and facilitate the activation of higher-order thinking and the development of advanced competences. A learning design could be built on/around a series of such tasks as an organized intervention. To summarize the above, we note a fairly divergent set of tasks that utilize Wikipedia and contain more ideas than the corresponding set for the traditional encyclopedias (information gathering and starting point of study).

## **Summary**

The present work reports the review and analysis of 24 research articles concerning the Wikipedia's educational applications. The analysis axes include the expected learning outcomes, the knowledge fields-subject matters of the learning interventions, and the task assigned to the students. As it comes out from the review, in the first decade of Wikipedia's existence, the educational community invented a rich variety of ways to utilize Wikipedia's wealth and interactivity in learning design.

The analysis reveals a number of distinct expected learning outcomes for several knowledge fields in secondary and higher education. Some of these learning outcomes such as, critical thinking, collaboration competence, digital and information literacy, research and inquiry skills, are quite current and are included in the core competencies that are cultivated by modern educational systems. Because of its advantages and the unique support for critical analysis of information and for the collaborative writing of scientific articles, it provides, the

uses of Wikipedia towards the achievement of these outcomes can be characterized as innovative and promising,

As far as the students' tasks are concerned there is also a variety of attractive options which are student centered and consistent to the modern social constructivist learning theory. The educational interventions that utilize Wikipedia found in the sample works of the review are of high quality, thus giving added value to the open online encyclopedia. Furthermore, these interventions constitute a superset of the possible educational uses of traditional, paper-based encyclopedias or even of the uses of the proprietary and/or electronic encyclopedias. The findings from the analysis surpass the authors' initial expectations and are characterized by originality and diversity.

The Wikipedia's unique features of collaborative writing, revisions history and interaction with other readers and authors to receive feedback, provide significant support in the design and development of innovative learning experiences. In general, the findings in terms of variation are fairly rich and surpass the expectations of the authors despite the fact that common and expected learning design models like webquests do not exist in the analyzed publications. Another not expected finding is the lack of published researches about primary education level. The specific developmental features of the children of primary education level require special educational design and this literature review shows a lack in systematic research of this issue. The lack of published research seems to be a paradox because it is a common belief that children are often using Wikipedia for school assignments.

The contribution of the present work lies in the inspiration of teachers towards the direction of designing learning experiences that utilize Wikipedia and involve tasks that go beyond the simple and obvious information retrieval for several learning goals. More specifically, apart from presenting an analysis of a set of complete interventions that exploit Wikipedia, the present work aims to inform teachers and educational designers about the possible learning outcomes that could be pursued through the use of Wikipedia as well as about student tasks that could serve as the building blocks for learning activities. In the future, this work could be extended to include newer published works, and/or could be used as the basis for the design and evaluation of a professional development program for teachers, one that could drive the design of learning activities that utilize Wikipedia. The authors anticipate that the ideas presented in the article will help teachers and learning-designers to efficiently and effectively use both the wealth of Wikipedia's content and the community of its users in their practices.

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