# Chapter 22
# A Social Approach to a *Wiki Course* Building


**Carlo De Medio, Fabio Gasparetti, Carla Limongelli, and Filippo Sciarrone**

**Abstract** Wikipedia has become the most used source of didactic materials with its immense number of Wiki pages, freely available to anyone. Wiki Course Builder is a Web platform designed to help teachers building courses composed by Wikipedia pages only, directly taken by the Wikipedia free encyclopedia. One of the interesting and novel features is the *Community* module, that provides a collaborative environment, through a suitable Graphic User Interface, where teachers can interact with all the courses in the platform. The Community is a graphical visualization of the Wikipedia pages used by all the teachers in the systems, grouped in clusters, each representing a particular topic. Another characteristic is the information about the Teaching Styles of those teachers that have used that page in their courses. This feature has a twofold advantage. First, each Wikipedia page is tagged with the Teaching Styles. Second, this social aspect gives useful suggestions for possible extensions or changes in the courses. We present a complete use case showing the usefulness of the social *Community* environment to speed up and improve the course building activity.

**Keywords** Course building · Social learning · Machine learning

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## Introduction

In recent years, distance learning has made significant progress thanks to the ever-growing availability of meaningful information material, in the form of HTML pages or other formats, including multimedia ones. Moreover, in the last time, due to the pandemic caused by COVID-19, the use of distance learning and web platforms has become of fundamental importance to guarantee the continuity of teaching for students of all ages in the context of smart cities as well [12, 14]. Many Web platforms have been implemented, both to provide distance courses and to offer a service for collecting and filtering learning materials on the Web. For instance, *Merlot* (http://www.merlot.org) is a web educational repository that makes learning objects freely available to teachers and in general to the educational community. *Coursera* (www.coursera.org) is the most used Web educational platform which delivers courses to hundreds of thousands of learners, acting as a Massive Open Online Course platform. Consequently, many teachers and instructional designers enthusiastically are more and more embracing the multiple educational opportunities offered by the Web 2.0. Environments, such as blogs and wikis, have rapidly increased their popularity because of their powerful opportunities to use new educational paradigms such as *Social Constructivism* [15], *Social* and *Collaborative Learning* [1], *Active Learning* [11] and *Communities of Practice* [16]. Wikis are online environments suitable for collaborative projects, having an intrinsically social and collaborative nature. Today many teachers have adopted Wikis, transforming them into a sort of *agora* of their courses since they promote a more spontaneous and flexible interaction between teachers, learners and didactic environments. Wikipedia is the most famous and used online Wiki-encyclopedia with free, collaborative, multilingual and free content, born in 2001, supported and hosted by the *Wikimedia Foundation*, a no-profit organization. Many teachers and students use this resource as a source of learning material to be used in their courses, to teach or to learn, also because their content is not bound by strong constraints on copyright rules being of *Creative Commons* (www.creativecommons.org) type. Moreover, Wikipedia is a large set of HTML pages, with conceptual connections among them, represented by links, easily to be managed by suitable API. *Wiki Course Builder* (WCB), is a Web-platform developed at our department, working with Wikipedia pages and developed to help teachers to build on-the-fly online courses [3, 8]. In this paper, we show a new particular module of the system, the *Community* module, which allows teachers building a new course. Teachers can take advantage of courses already developed by colleagues, by using resources, i.e., Wikipedia pages, already in use, thereby saving time. All this through a suitable graphical interface. Furthermore, each teacher using the system, is modelled through her *Teaching Styles* according to the Grasha model [6]. The interface allows to select teaching materials belonging to other courses through a set of colours that express similar teachers, that is teachers having almost the same teaching styles. Here we present a case study showing the Community process, with the aim to verify, through a sample of teachers, the feasibility of such an approach.

The remainder of the article is organized as follows. Section "Related Work" illustrates some important related works. Section "The WCB System" shows the main features of the WCB system, focussing on its *Community* feature. Section "A First Evaluation" shows an experimentation based on a use case while the conclusions reported in Section "Conclusions and Future Work" close the article.

## Related Work

Distance learning literature mainly focuses on student learning, so most of the proposed systems are student-centred. Collaborative e-learning environments often intend the role of teachers as a support and a coordination among groups of students groups during their learning activities [9] and during the peer review phase [2, 13]. WCB is a system that has been developed to help teachers to quickly build a new course composed by Wikipedia pages only. Here we present some comparisons with similar systems where the collaborative aspect in the construction of a new course is present.

*MoodleREC* [4] is a recommending system that helps teachers configure new courses in the Moodle Learning Management System (www.moodle.org), based on courses already built by the community of teachers using the same platform. This system uses some standard Learning Object Repositories, like Merlot and Ariadne, to retrieve didactic materials. Moreover, it uses a social approach to course building by suggesting a learning object for a new course taking into account other courses where it was already used, in the Amazon recommendations style. Differently, WCB uses teaching styles to recommend a new Wikipedia page, using a graph-oriented environment, thus making the recommendation process simpler.

In [5], a machine learning approach for the identification of relationships between text-based resources is proposed, to build new learning paths on Wikipedia pages. A feature selection methodology allows to consider the most relevant attributes to the predictive modeling problem for the set of topics under consideration. These features are extracted from both the input material and weak-taxonomies available on the web. Natural language annotation processes the input data in such a way that patterns and inferences of interest are more easily found by an automated analysis. Finally, the prerequisite identification is input to a binary statistical classification task. This approach does not take into account the teaching styles of each teacher and learning paths are built based on some machine learning algorithms. Our system presents a personalization aspect in the selection of learning material, thus making the course building process more adapted to the teacher.

In [10], the authors present a method for automatic generation of learning paths for education or self-education. As the knowledge base, their system uses the semantic structure of Wikipedia, leveraging on its broad variety of covered concepts. The system experimental evaluation showed its usefulness. Our system is a complete system that allows to build and manage a complete course, other than suggesting learning paths.

In [4, 7] the authors present a system that gives some support to the operations of retrieving, analyzing, and importing LOs from a set of standard Learning Objects Repositories, acting as a recommending system. In particular, it is designed to support the teacher in the phases of (i) retrieval of LOs, through a keyword-based search mechanism applied to the selected repositories; (ii) analysis of the returned LOs, whose information is enriched by a concept relevance metric, based on both the results of the searching operation and the data related to the previous use of the LOs in the courses managed by the Learning Management System; and (iii) LO importation into the course under construction.

## The WCB System

In this section, we briefly present the WCB system, focusing on the *Community* module. For a deep insight into the system, the reader can refer to [3].

### *The General Architecture of the System*

The general architecture of the system, developed in java and based on the *mongo* no-sql database, is shown in Fig. 22.1.

The system is composed of several functional modules:

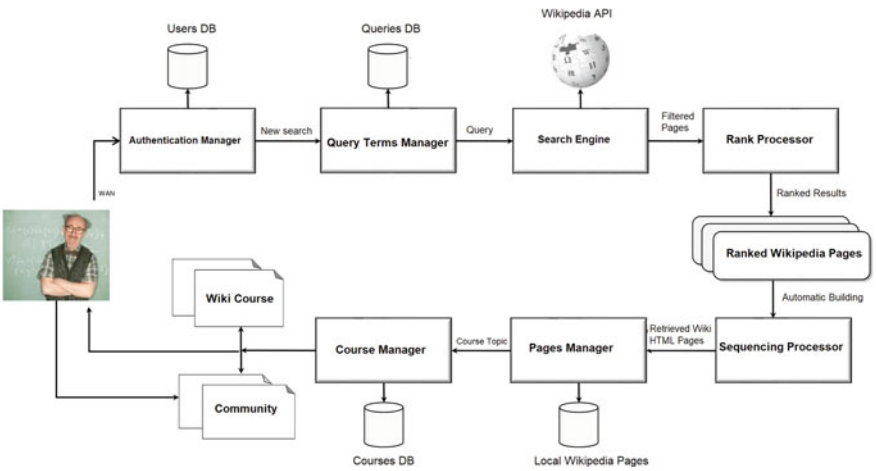


**Fig. 22.1** The WCB architecture

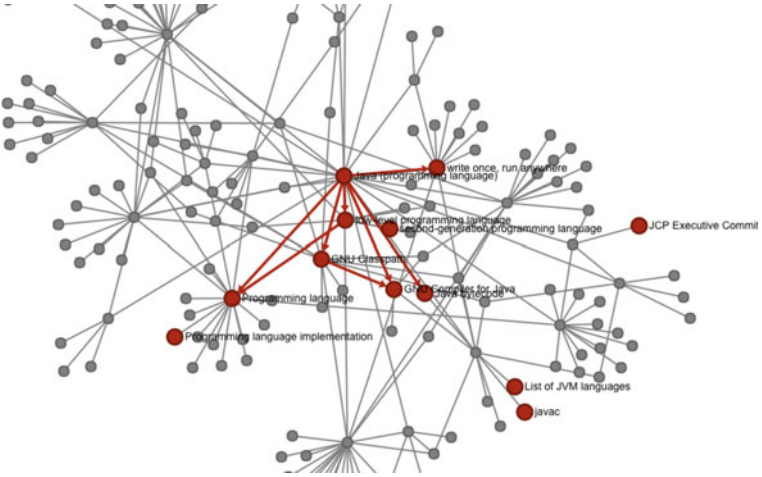


**Fig. 22.2** A portion of Wikipedia graph after a query

- The Authentication Manager. The login manager manages the access to the platform, allowing users to sign in to the system, profiling each teacher's learning styles, using the Grasha and Riechmann test;
- The Search Engine. The search engine retrieves the links to probably relevant Wikipedia pages, taking into account different evaluation metrics, among which the one based on the teacher's teaching styles is the most important;
- The Recommendation Processor. The recommendations processor deals with the retrieving and the ranking of the Wikipedia pages. Starting from the page selected by the user during the search phase, this module extracts a set of Wikipedia pages. The pages are selected by exploring and analyzing a portion of the Wikipedia semantic graph, that is the graph built starting from a Wikipedia page and taking all the linked pages. Each node represents a page together with the concept associated with it. The arcs are the links between the pages. The user can view the sub-graph composed by the retrieved pages, as shown in Fig. 22.2 where, after a query, the teacher can analyze the learning path generated by the sequencing of the retrieved relevant pages. Figure 22.2 shows the idea of the graph that can be explored by the teacher instead of navigating the Wikipedia pages directly on the web.

## *The Community Module*

The *Community* module is the relevant feature focus of this work. When launched, this module presents all the courses, where each Wikipedia page is tagged with five colours, each representing the mean of all the teaching styles of the teachers who used it. So, a teacher can explore the graph searching for new pages adapted to her

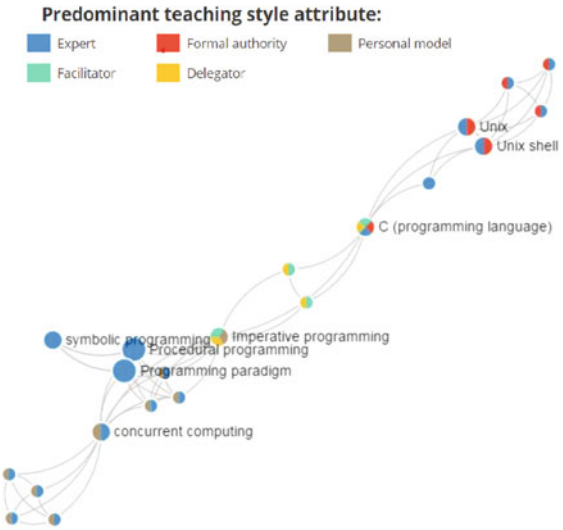


**Fig. 22.3** An example of the Community graph with their associated teaching styles

way of teaching other than to her course. An example of a community graph is given in Fig. 22.3 and shows all the courses currently in the system (see the use case in the next section), coloured according to the values of the teacher's teaching styles. The graph can be filtered by topics allowing teachers to use this social tool to enrich their courses with didactic materials belonging to other courses and with similar teaching styles, improving the sharing and reuse of Wiki pages.

A teacher $t_i$ is characterized by a set of five real numbers $TS_i = [ts_i^1, ts_i^2, \ldots, ts_i^5]$, being $ts_i^k \in [1, \ldots, 5]$ indicating her level in that particular category of the teaching styles set, that is $ts^1$: Formal Authority, $ts^2$: Expert, $ts^3$: Personal Model, $ts^4$: Facilitator, $ts^5$: Delegator.

Each wiki page used by $n$ teachers in their courses has an associated $TS$ given by the mean of all the $TS_i$ of the teachers that have chosen that page for their courses. So, the algorithm tags each page with the $TS$ of the teachers that used it. The rationale behind this choice is that it is possible to see which kind of teachers (on average) have chosen a given page. In this way, implicitly, we specify that a given page is more appropriate for a teacher with a set of given teaching styles, because (on average) it has been already chosen by teachers with similar teaching styles. In other words, a generic page $wp_j$, has associated a $TS$ set, after $n$ choices of the same page, that is computed as follows:

$$ts^k(wp_j) = \frac{\sum_{i=1}^{n} ts_{ji}^k}{n} \tag{22.1}$$

where $ts^k(wp_j)$, with $k = 1...5$ is the value of the $k$-th teaching style associated to the $wp_j$ page. The Equation 22.1, expresses the updating page rule.

## A First Evaluation

In this section, we present a first experimentation of the system, with the aim of verifying our research question.

### *The Sample*

We experimented the *Community* environment by means of a sample of 10 teachers who produced the learning materials shown in Table 22.1. As summarized in the Table, were used 192 Wikipedia pages, created 72 topics and 21 courses on the

**Table 22.1** The learning material produced by the sample

| Course ID | Title | # Courses | # Pages |
|---|---|---|---|
| 1 | Computer History | 4 | 12 |
| 2 | C Language | 3 | 11 |
| 3 | Artificial Intelligence | 5 | 16 |
| 4 | The Microprocessor | 4 | 12 |
| 5 | Ricursion | 4 | 12 |
| 6 | The Microprocessor | 3 | 9 |
| 7 | The router | 3 | 9 |
| 8 | Internet of Things | 4 | 10 |
| 9 | Files management in C language | 3 | 10 |
| 10 | Pointers in C Language | 4 | 12 |
| 11 | Binary arithmetic | 3 | 9 |
| 12 | Binary Representation | 3 | 10 |
| 13 | Astract Data Type | 4 | 13 |
| 14 | Sorting | 3 | 9 |
| 15 | Binary Trees | 3 | 9 |
| 16 | Prime Numbers | 3 | 9 |
| 17 | Image processing | 3 | 9 |
| 18 | Deep Learning | 3 | 9 |
| 19 | Object Oriented Programming | 3 | 9 |
| 20 | The Assembly Language | 4 | 12 |
| 21 | The Computer Hardware | 3 | 9 |
| | | 72 | 190 |

**Table 22.2** The Grasha teachers' model of the sample

| Statistics | Delegator | Expert | Facilitator | Formal authority | Personal model |
|---|---|---|---|---|---|
| $\bar{x}$ | 2.9875 | 3.6625 | 3.2875 | 3.7875 | 3.45 |
| $\bar{s}$ | 0.487674 | 0.409896 | 0.316146 | 0.586979 | 0.195138889 |


**Fig. 22.4** The use case

Computer Science domain. Each course created by the sample was composed by at least 3 topics and each topic by at least 3 Wikipedia pages. All the invited teachers filled in the Grasha questionnaire with the results, shown in Table 22.2 where the values of the standard deviations are much lower than the averages, thus indicating a fairly homogeneous sample.

All the teachers accomplished the requested task to build new courses. After that, each of them used the *Community* feature in order to verify the added value of the proposed social approach. In the following, we show a use case of a user who used the social instrument to improve her course.

## *A Use Case*

Figure 22.4 shows the use case that expresses the user-system interactions in the classic UML use case diagram.

**The results of your teaching style survey are as follows:**

| | | | | |
|---|---|---|---|---|
| 2.875 | 3.375 | 3.375 | 3.25 | 2.875 |
| expert | formalauthority | personalmodel | facilitator | delegator |
| Moderate | High | Moderate | Moderate | High |

**Fig. 22.5** The teaching styles associated to user 1 by the Grasha-Riechmann Questionnaire

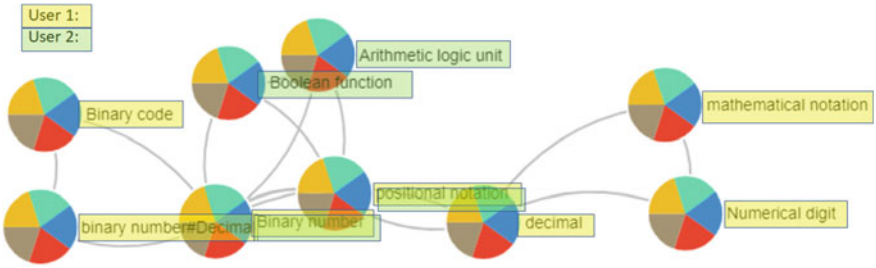


**Fig. 22.6** A snapshot of the community environment

Once a teacher (user1) signs in into the system, she has to fill the Grasha Questionnaire. It is composed by 40 questions articulated according to statements, such as: —"My objectives and teaching methods address a variety of learning styles of the students", or —"Take the time to consult the students on how to improve their work in individual projects or group". In Fig. 22.5 the teaching styles of the $user_1$ are shown.

**Building a new course** Let us assume that $user_1$ is the user of the sample who wanted to prepare a module about *Binary Arithmetic* concerning the general topic *Computer Representation*. She just digits the appropriate keywords and selects four wiki pages: binary code; binary number#digit; binary number and positional notation.

**The Community Module** Going into the community she finds the situation given in Fig. 22.6.

Namely, $user_1$ observed that someone else in the community has already used the wiki pages "Binary number" and "positional notation", linking these pages to other pages such as "Boolean functions" and "Arithmetic Logic Unit". Since the topic $user_1$ is going to create is oriented towards computer arithmetic, she included in her module these new two pages.

This experimentation is currently in progress because the sample is still using the system. To date, other 5 teachers have used the Community feature to enrich their courses with other pages taken from other courses. This is a good result that encourages us to continue the experimentation.

## Conclusions and Future Work

In this article, we introduced a new feature of the WCB system, a system that helps teachers building new courses based on Wikipedia pages. The new feature is based on the possibility of using a social and collaborative environment, typical of communities of practice. Through a graphical user interface, teachers can filter all the other courses built by other teachers through the most appropriate teaching styles associated to Wikipedia pages. In this way they can select teaching materials, i.e., Wikipedia pages, provided by other teachers with similar teaching characteristics. This work presents a first experimentation carried out with 10 teachers, who have expanded their courses with materials semantically related to their teaching goals. The limitation of this approach is that teachers can only navigate on Wikipedia pages. On the other hand, this approach allows a rapid creation of courses and contributes to a first rapid approximation of what will be the final course. As a future development, we are going to allow to integrate didactic resources taken elsewhere on the Web into the courses. A further and more stimulating development is to extend the Teacher Model. It could be enriched with more information, for example, with the "didactic history" of the teachers represented by their courses. This will allow a fine-grained exploration of the community. Teachers could be classified on the basis of their teaching styles and on the basis of the topics taught.

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