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Development of an open source digital educational ecosystem: Case study

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Abstract

A real sustainable open source digital educational ecosystem, is presented in this work, developed and described according to theory and working concepts of digital business ecosystems. Adapted for educational needs, some generic terms should be unpacked as follows: digital, refers to ICT infrastructure, applications and services, conceptual frameworks and etc; educational, refers to training modules, digital rights, knowledge sharing, and finally ecosystem, refers to biological metaphor, of an evolutionary online environment, in the state of permanent improvement, according new technologies and social trends. Following case study explain all of those described terms on real digital educational ecosystem, which is developed for educational needs of academic courses of programming languages, on few levels: ICT infrastructure: open source tools, blogs, widgets and storage services, code generators, Google services etc.; Social interaction: surveys, forums, information boards, digital rights management; and Permanent educational improvements: feedbacks from surveys, use of alternative educational services.

Keywords: Digital educational ecosystem, open source technologies.

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1. Introduction – Paradigm of Digital Educational Ecosystems

The processes of knowledge change and sharing persist long time ago, before the advent of digital technologies. In new digital society this process should be organized according to principles and paradigms of digital educational ecosystems, as a new kind of digitalized education. Digital educational ecosystems, precisely, it's digital living environment, might be analysed as an evolutionary executive environment, which entities according to Reyna (2011) can be described using following terms:

- Biotic components, such as entities involved on teaching processes, like educators, contents creators, system administrators.
- Abiotic components, which comprise all supportive ICT components (network solutions, software, hardware, services, etc.)
- Source of "living" energy which powers digital educational ecosystem is educational process, considered as transformative process where information generate knowledge.

Communication rules and social interaction between ecosystem's component might be described as a biotic-biotic and biotic-abiotic. Both of them are based on Darwinian theory of evolution and ecosystems, which guiding principles are interoperability and adaptation, like most important conditions to survive and growth.

2. Structural Principles of Digital Educational Ecosystem

Some researches prefers use of term "digital learning ecosystem", which favors autonomy over strict guidance (Atif, Bard & Maamar, 2010), likewise possibilities of customization whereby learners interact with educational environment choosing contents, learning time and level. Otherwise, digital educational ecosystems refers to special kind of knowledge sharing, obviously related to set of educational standards. To reach these standards it is necessary to have some mechanisms that should ensure quality evaluation of educational processes. The main substances of digital educational ecosystem are knowledge and information. The main values generated on the working processes in this ecosystem are: deepening and growth of knowledge, selection and interpretation on relevant information. Followed information might be used in evaluation processes of education and social interaction. Further, those findings were implemented as some criteria for choice of a new ICT solutions. Main processes in classical education include contents management activities, selection and implementation of new teaching methods, with intention of permanent improvement of education.

2.1. Structural coupling between educational ecosystem and digital ecosystem

Concept of digital educational ecosystems might be explained toward similarity and comparison with digital business ecosystems. Further, digital educational ecosystems, can be decomposed on two structural entities: educational ecosystem and digital ecosystem, which coexist on a special way. Structural coupling between educational and digital ecosystem is a form of mutual and symmetrical interdependence, between those two entities, that, at any point in time is determined by each entity's previous structure whilst being triggered by the other (Dini & Nachira, 2006). That situation means that nothing in nature ecosystems exist by itself, and everything interacts with everything else.

According to Figure1, generic term structural coupling can be explained, as follows: digital ecosystem provide digital presentation and decomposition of used ICT solutions, which support knowledge and information management system in educational processes. This is, on a some way, digital representation of supporting tolls and mechanism for education concepts, which are used for aggregating and recommending services for educational purpose. Educational ecosystem refers to development of an functional decomposition of educational processes, where contents and information are adapted to be stored, used and integrated into different abiotic software entities (blogs, storage services, surveys, widgets, code generators etc.). All changes as a result of symmetric interdependence leads to permanent improvement. Those changes leads, not only to growth and

adaptation of used technologies and software services, but also to improvements of basic educational processes, selection of new relevant information, adaptation and creation of educational contents.

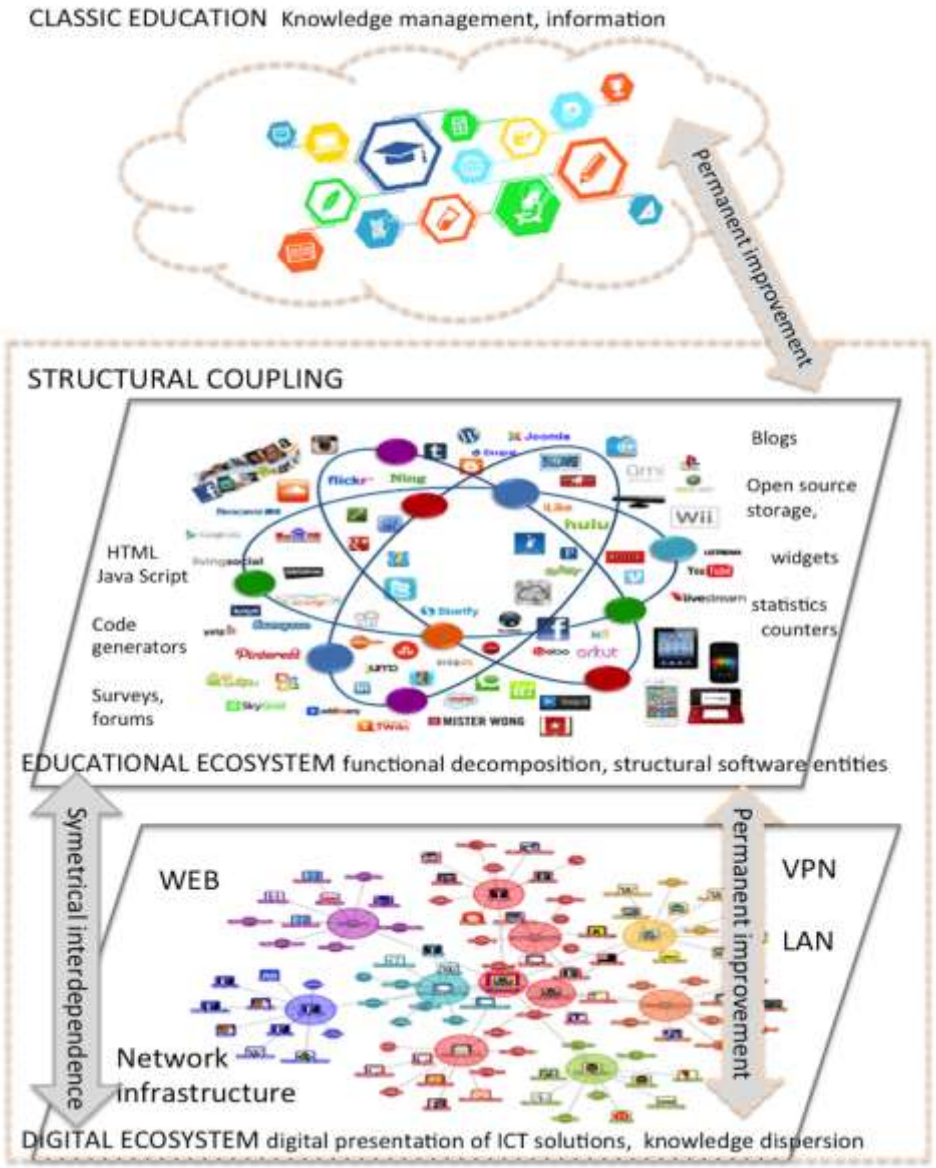

Figure1. Structural coupling between digital and educational ecosystem

3. Development of an Open Source Digital Educational Ecosystem

Depending of focus of working activities, there are two basic approaches how to explain and realize paradigm of open source educational ecosystems:

1. From theory toward realization: which is good only when creators have lack of practical experiences. This approach should start as a minimalistic concept, stable and simple realization, which

lead to limited functionality. Explanation of this approach should be started with elaboration of many working concepts such ad network support, service as a software, service oriented architecture etc. This is the most common approach which offer good understanding of supporting processes and ICT solutions, but with lack of useful practical information. This is a deductive approach of building ecosystem from known toward something new, step by step.

2. Realization based on theoretical issues as a starting point, but permanently improved over working experience. This is inductive approach, also starting from simple stable practical solution, with intention of planed growth, using theoretical recommendations, combined with working experiences.

Both of those concepts leads to realization of open source digital educational ecosystem, and offers opportunity of scalability. This is important to ensure stable growth and functionality into external online environment, where digital educational ecosystem persist. Choice of this work is description of second approach, using real practical experiences, based on open source free platforms, with a special review of adaptability and crossover compatibility of partial parts, abiotic entities of digital educational ecosystem, briefly called educational ecosystem.

3.1. Functional components of an open source digital educational ecosystem

There a few potential solutions, but according following openness for upgrade, it is recommend to choose a free platform like blog, as a working core of an open source digital. Depending of expected functionality, there is a option to start with minimum needs, which means use of the following possibilities:

- Standard blog elements, for organizing and recognizing content on the internet, like headers, footers, design supporting elements.

- Main space, which is standard element, for editing and present different kind of post. The same post might be organized like content in standard text editor, combined with pictures, tables and other basic element, or like code content, commonly HTML. Unlike standard posts witch are limited to simple contents, this possibility to import code, gave an opportunity for use of advanced services for different content storage. There is no limitation to combine both of them kind to creating post: standard text editor with HTML code in same content. Before, it is necessary to create embed code and adapt them according working rules of main blog content, which needs some practical experience.

- Side bars, witch is also, standard elements, with purpose to present some additional functionalities. There are two basic kind how to adapt those contents:

  - Use of standard contents, which might be configured on a relatively simple way, using standard drop and down options on standard layout configuration;

  - Use of adaptable widgets, which gave an opportunity to combine HTML, CSS or Java Script code, onto main code of basic blog, and import on this way completely new qualitative changes on basic blog. Depending of way of code creation, there are also, two scalable options:

- Use of services which are capable to create embed code for different need, like multimedia contents, free mail widgets, groups, chats or services, free storage services, forums, surveys, connections with social networks, statistic trackers and counters, translators of pages etc.

- Use of code generators, which gave an opportunity to create own code according the needs of different kind of users, like informational boards with some active element, active banners with hyperlinks, and other elements. Additionally, code generators offers some advanced options for customization, like adaptation of visibility, dimensions, colors, speed of change on dynamic elements and many other performances depend of widgets. This is the simplest way to creating own code and making changes on main HTML code, unlike opportunity of offline HTML editing, which need some advanced skills.

Figure 2 shows described conception for creating basic small educational ecosystem, stored on the cloud, which are developed as an online open source digital educational ecosystems. There in not limitation of use and combine many different blog platforms and widgets, on a many different ways, witch result on permanent growth and improvement. There are, also, online services which offer an opportunity to declare and regulate author's digital right. Further, as a working option of many services, and blogs, there are scalability of right and privileges over educational contents, like options to make changes, comment, download, read only use, view in special working mode, different levels of access, and flow control, behavior tracking of visitors. This feedback information might be used as one of criteria on the processes of knowledge management, especially, for choice of new contents and methods of their presentation.

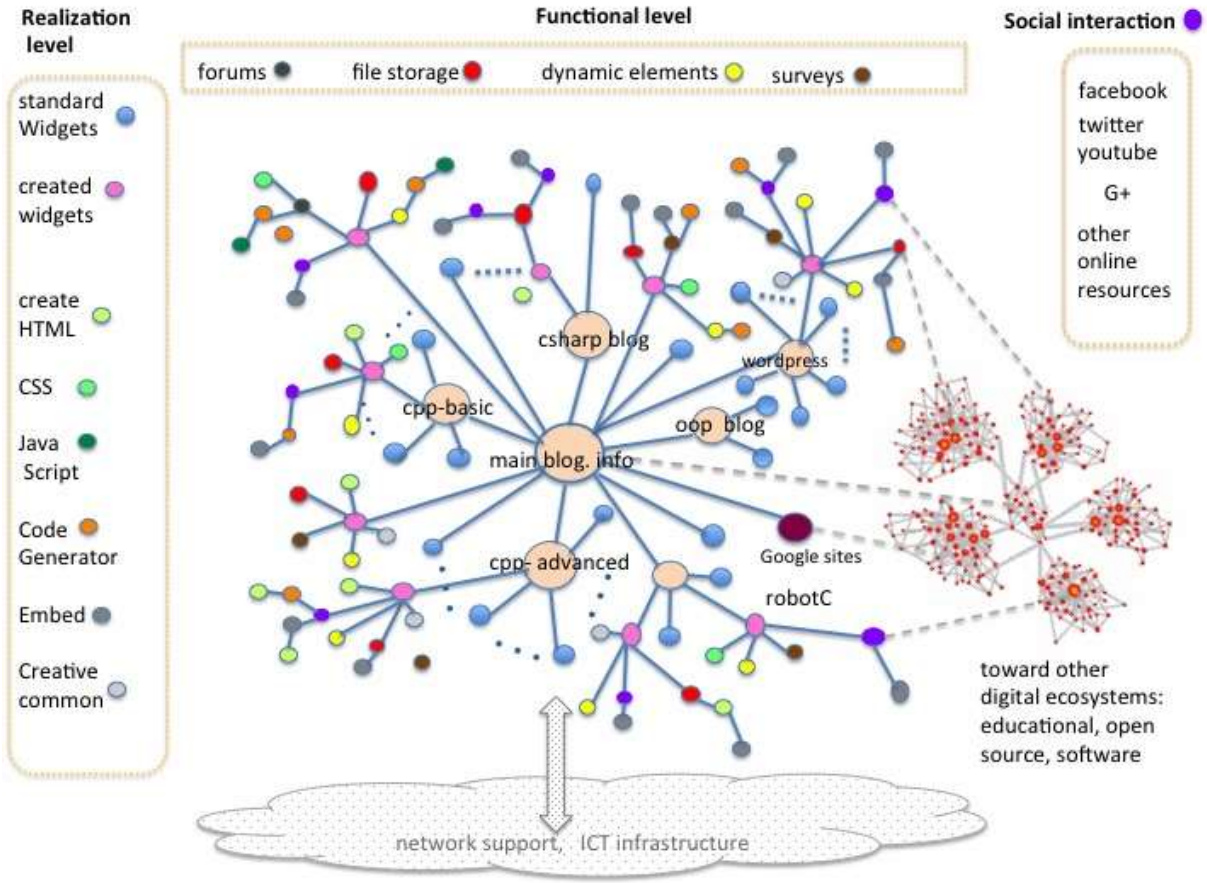

Figure 2. Functional decomposition of digital educational ecosystem

4. Open Source Digital Educational Ecosystem for Programming Languages – Practical Experiences, Case Study

Starting working platform of the followed digital educational ecosystem is BlogSpot (http://www.blogspot.com), whose HTML code might be decomposed and adapted in many different ways, depending of creator's skills. This approach enable an opportunity to growth for the creators

and educators and leads to concept of long-term learning for all, which supports the imminent intention for improvements. Therefore, following concept is only one of the possible solutions. There are many adaptable templates, with different sets of offers. The basic set of widgets might be proposed as a building part, directly on chosen template. Some of those widgets might be excluded according the will of content's creators. Advanced customization starts with ideas of creators, follows educational needs, and extends with search and adjustment of a new mainly cloud oriented tools: different kind of free services, repositories, code generators, statistic counters, activity trackers etc. There is many options, as follow:

1. Choosing content from other sites, and according creative common licence- digital rights:

a. Insert hyperlink to picked content, which might be: private, access only with invitation, or public link on the WEB.

b. Create and customize embed code, to became compatible with HTML code of main resource, which means choose of adequate dimensions, location, appearance etc. This way is optimal for multimedia contents such as clips (http://www.youtube.com), presentations, and other kind of files stored online..

2. Generate own content, which might be:

a. Contents with low memory needs, stored directly online, combined with the same embed code which support their appearance, such as informational boards, roll bars, banners, etc.

b. Contents, which needs to be stored on online repositories like scribd, might be embed according step by step recommendations on Figure 3. At first, content should be stored on some online repository (http://www.scribd.com), and after customization should be imported on main resource (http://www.ramona-markoska.info).

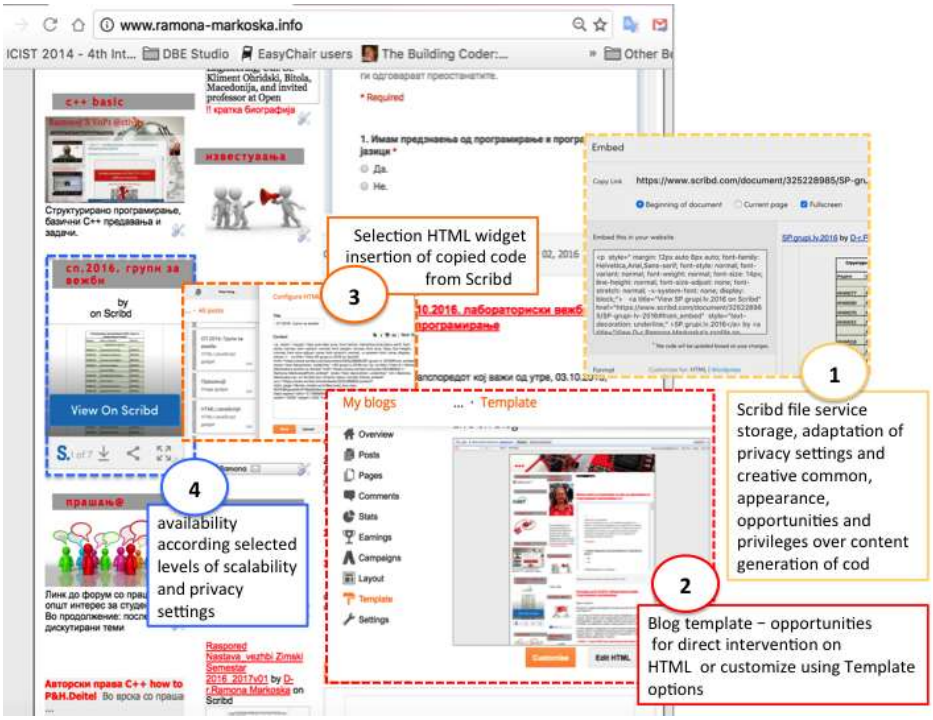

Figure 3. Process of content creation using configurable widget

In both of described options, depending on services where those content are stored, there are some recommended procedures for realization of embed options. Independently of embed place on the main resource, (blog post or imported widget), it should be defined and described opportunities and privileges over content, as a star point of process of embed code generation. Digital educational ecosystem might be composed from many independent, but functionally linked platforms, such as other blogs, in this case study:

- C++ Basic programming, (http://cpp-ramona.blogspot.com/),
- Advanced C++ programming, (http://cppadv-ramona.blogspot.com/),
- RobotC programming, (http://robotc-tfb.blogspot.mk/),
- Google sites used as files cabinet, (https://sites.google.com/site/ramonamarkoska/),
- C# visual programming (http://www.csharp-ramona.blogspot.com),
- Java, Object oriented programming (http://oop-ramona.blogspot.com)

Any particular realization needs customization, depending chosen functionality and limitations of main platform, where is planed to embed it. This approach gave an opportunity to permanent growth, importing many different functionalities, such as:

- Forums and free chats (https://www.pnyxe.shadow.com), with regulated communication rules.
- Code generators (http://www.htmlcodes.ws, http://www.csgnetwork.com/codegenconverters.html);
- Mail widget embed services (http://wikiworldbook.com/);
- Interactive banners with hyperlinks (http://www.bannersnack.com);

- Surveys, activity tracking, feedbacks forms, (https://www.google.com/forms/about/); with statistic and small data base, where collaboration might be realized as private or public, depending on level of educational needs.
- Direct online compiling opportunity with multi compiler support (http://cpp.sh/)
- Statistic counters and trackers (http://statcounter.com/, http://www.sitemeter.com) etc.
- Standard widgets for content translation, archive, calendar, pages into main blog, etc.

Described approach is focused intentionally on practical dimensions of realization of digital educational ecosystem. The main content of this educational ecosystem, http://www.ramona-markoska.info, is actually redirected from http://www.ramona-markoska.blogspot.com where persist since 2009, using low cost domain hosting solution.

4.1. Toward virtual university as a global digital educational ecosystem

Virtual world might be analyzed as a global ecosystem where coexist many kind of interconnected digital ecosystems, each of them on different level of scalability: business ecosystems, internet provider ecosystems, software ecosystems, and local independent educational ecosystems. From the other side, not only particular educators, but also, many traditional faculties and universities have begun to virtualize parts of their curricula. The beginning of digital education is focused on creating, sharing and accessing many different kind of digitalized educational contents. Today, digital education growth and move "from content to connection" (Banergee & Belson, 2015) which leads toward:

- Widespread social inclusion of significant participants, like parents, teacher, individuals outside the formal education, such as mentors, companies as well as potential employers.
- Integrated student learning life cycle, which refers integration of educational models and teaching methods, likewise educational contents.
- Integrated ICT solution
- Educational design studios, as a new concept (Jabbar & Kurshan, 2016), where universities as a equipped entities to bridge the gap between research and practice, have many opportunities to adapt their digital resources, and digitalize some activities (use of students as a beta testers of some adequate product, digital knowledge enriched with some market principles and many other options).

Given approach is focused only in development of particular resources, with possibility on their own will, according needs, to choose level of interconnectivity with other digital ecosystems. There is, also, two options, to begun a part of digital educational ecosystem developed as a support of traditional faculties and universities: to create educational ecosystem following own rules, and to link them to other official resources; or to create content following official rules, but using free tools and ICT support. This open source approach, based on use of free resources, and every user's adapted standard configuration of ICT support (internet providers, LAN, VPN), is focused on management of ICT enabled solution and tools, use them and adapt them according skills and needs (Markoska, 2013), unlike approach which starts with analyzes of network support, middle wears, infrastructures as a service, software as a services, which must continued with practical rules at the end. The most effective and easiest way to growth toward virtual universities as a globalized digital educational ecosystem is to start with content creation, and unite them, according working principles and law recommendations of real faculties and universities.

5. Conclusions

Creation of this work leaning on long-term activities on creating online educational recourses in the area of programming languages. This is a process which needs permanent follow of a new standardization issues in area of programming languages and software upgrade, likewise new trends and technologies for creating online contents. Therefore, the process of creating online digital

educational ecosystem, is inductive and dynamic, where simple contents and solution, permanently growth and moving toward a new quantity and quality. There is always options for scalability of selected solutions, depending of knowledge level, needs, and skills of participants (educator, students). Unlike other forms of education, concept of digital educational ecosystems stimulates continuous improvement, which result to permanent changes, likewise natural ecosystem, where, according to Darwinian theory, imperative to survive, is not to be strongest, or biggest, but the best adapted. The same process of structural coupling initialize the process of quality loopback, in which persist as ecosystem's entities and habitats together, new abiotic contents, nested and supported by new technologies, with biotic entities, students and teachers, etc. This is an new paradigm of evolutionary executive environment completely fit for new digital world, open for interconnectivity between many digital educational ecosystems, supported and enabled to growth toward virtual university, in new virtual world, as a union of many different kind of interconnected digital ecosystems.

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