Strategies for Teaching in the XXI Century

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Edited by

Fernando J. Garrigos-Simon,
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Cambridge
Scholars
Publishing

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This book first published 2015

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-4438-7723-9
ISBN (13): 978-1-4438-7723-7

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PROLOGUE

STRATEGIES FOR TEACHING IN THE 21ST CENTURY

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Globalization, technologies, cooperation between universities and businesses, the internationalization of research and training, and the offshoring and dispersion of knowledge creation and transfer mean that universities around the world must adapt to new surroundings. This shift has had a significant impact on the education system, not only at undergraduate and postgraduate level, but also in primary and secondary education, as well as in the ongoing training of business personnel, which offers a response to the demands of the environment.

In this context, Europe has embarked on a process to bring the European higher education system under one common framework. Numerous meetings and summits have aimed at establishing this new framework, starting with the Bologna Declaration of 19 June 1999, whereby the ministers of Education from 29 European countries committed to introducing a common educational model to establish a European Higher Education Area (EHEA), and culminating in the conference of European ministers in Bucharest in April 2012. These actions aim to realign the focus of the European educational system by placing an emphasis on lifelong learning, equal access to education, ease of mobility, and an increase in employability to foster economic, social and personal development. Together with the development of new technologies and the breaking down of barriers to knowledge, this educational landscape calls for a new focus that encompasses both teaching methods and learning assessment, and provides the necessary skills to respond effectively and efficiently to the challenges of the 21st century. Within this framework, education must fulfil the principles of quality, mobility, diversity and competitiveness, and must look to boost employment in the European Union. Similarly, education must also seek to convert the European higher education and training infrastructure into a system that enables mobility for students, teachers and researchers through a transferrable credits system whereby multiple institutions may jointly issue a single qualification, thus enabling economic growth and fostering a sense of belonging to a common social and cultural sphere.

Throughout its 19 chapters, this book presents various models of teaching and learning to provide students with the tools and skills (chapters 4 and 19) necessary for success in a highly competitive, rapidly evolving, global labour market, where linguistic proficiency is increasingly important (chapters 3 and 10). This book's scope runs from primary education (chapter 11), through to compulsory education (chapters 16 and 18) and finally higher education whose aim, among others, is to obtain the "Diploma Supplement" of the Bologna Process (chapter 7), which facilitates the free movement of future graduates within the European Union.

Knowledge, and the means of transferring this knowledge, have changed. The teaching and learning model has evolved from being teacher focused to student focused. In this new model, lecturers must engage with their environment (chapter 6), creating a learning space where students can work autonomously. Teachers play the role of facilitators in the process of knowledge creation and transfer, and they must encourage and guide students by using collaborative techniques rooted in new technologies such as wikis (chapters 2 and 5) or Twitter (chapter 12), employing active learning methodologies (chapters 8 and 15), and fostering an environment of self-study for their students.

This book presents a range of teaching methodologies (chapters 13 and 14), as well as skills assessment (chapter 9)—a fundamental aim of teaching and learning in the 21st century. Similarly, this book also covers the use of novel teaching platforms to improve communication (chapter 17), new software to enable the acquisition and horizontal transfer of knowledge (chapter 1), and self-study.

Finally, socialization and free access to education throughout a person's life must become the key elements of educational policy in the 21st century so that our graduates are able to respond effectively and efficiently in a dynamic, ever-changing environment. This implies a shift in focus at a global level, which institutions must seek to implement. The philosophy of online education (chapter 13), ICTs and the range of teaching and learning strategies put forward in this book will help students, lecturers, professors, politicians and society as a whole meet these challenges.

CHAPTER ONE

INNOVATIVE MANAGEMENT OF THE SELF-LEARNING PROCESS FOR STUDENTS OF HIGHER EDUCATION THROUGH BUSINESS PROCESS MANAGEMENT

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1.1 Introduction

Integration of Spanish universities in the European Higher Education Area (EHEA) has meant a conceptual and methodological change for teaching and learning and the conditions under which they take place (e.g. LOU, 2001; Pagani, 2002; González and Wagenar, 2003; MECD, 2003; R.D. 1125/2003; R.D. 55/2005; R.D. 56/2005; ANECA, 2005). This change has brought with it a teaching model that places students at the centre of the entire educational process, thus requiring a redefinition of teacher and student roles (ANECA, 2005). In traditional education and training the teacher directs the teaching, asks the questions and sets the rhythm of the class. This new student-centred learning model, however, demands a different role from teachers. In their new role "the emphasis must be on the students' own intellectual processes and on collaborative learning" (Harasim et al., 2000: 198). The trainer's new role focuses fundamentally on stimulating the group, organizing the activities, motivating and creating a pleasant climate for learning and being an educational facilitator, providing experiences for self-learning and knowledge building (Paulsen, 1992: 2).

In this scenario new teaching strategies must therefore meet this challenge by enabling students, with the tools the teacher provides, to resolve the problems they encounter when engaging with the contents of the subjects being taught. Teaching strategies impact on the quality of the educational activities, and teaching staff need a wide repertory (Cabero, 2006: 8). The range of activities available to teachers is very broad and forces exhaustive consideration of the most appropriate activities for the proposed in the teaching sequence. The intended objective is, of course, more important than the activity itself.

In this context, we use a new business methodology, Business Process Management (BPM), with a twofold objective: to teach students to use BPM software with a view to its practical application in managing business processes, adding value to the subjects in which it has been taught and, as a new feature, to apply a new functionality of this software that helps students to develop their own self-learning process.

In short, with the same work, we achieve two applications and two real benefits. One benefit is strictly limited to the field of business knowledge, the context for the subjects (business process management) and the other benefit is interdisciplinary, in that students find it useful for managing their self-learning in any area (self-learning management).

The chapter is structured as follows: Section 2 examines the importance of integrated learning; Section 3 presents the importance of competence training and links it with this experiment; Section 4 looks at BPM methodology; Section 5 describes the teaching experiment in the classroom; and finally, Section 6 presents the conclusions.

1.2 From knowledge transfer to integrated learning

European universities are currently faced with a pressing need to adapt to a series of deep changes. These changes are linked to the increased demand for higher education, the internationalization of education and research, effective close cooperation between academia and industry, the multiplication of sites of knowledge production, the reorganization of knowledge and the creation of new expectations. This process of change proposes a new philosophy of education. Teaching stops being an activity where a teacher transfers and evaluates knowledge to become part of an active process where its function is to guide learning. Thus this approach emphasizes the importance of active exploration and problem solving as a natural and preferable way of learning.

In this context, teaching-related competencies shape all the tasks required for quality education and are a reference for students' professional training and development (Fernández-March, 2003: 179). In universities, teacher competencies currently range from planning teaching and learning, selecting and preparing content, providing information and understandable, well-organized explanations, managing and using the new information and communication technologies (ICTs) as a format for storing and exchanging information, designing work methodologies and organizing learning activities and tasks, tutoring students, evaluating and reflecting, to research in teaching. Although all these activities are important for good teaching, the most important one is probably the planning of learning and teaching as the other competencies depend on this process to achieve their objectives.

All teachers have to plan the teaching process and so first they must decide what they want to teach, that is, define their learning objectives and choose the content required to achieve them. Second, they must decide when to teach, which involves sequencing objectives and content. Third, they must decide how to teach, by deciding what teaching and learning activities to use. And finally, they have to decide what, how and when to evaluate. This adaptation involves a substantial change in teaching and learning methods which have gone from being teacher centred to student centred. Teachers thus seek contextualized, complex learning situations, focused on developing students' ability to apply and solve problems that are as real as possible. Thus the content of the discipline becomes a vehicle for proposing different learning and teaching strategies that integrate the *what* (which is knowledge), with the *how* (procedural knowledge) and the *why* (conditional knowledge) (Fernández-March, 2006: 40).

In short, teaching and learning has become a process of guidance, help and advice from teachers to achieve different objectives such as integrating students in the technical and human training environment, solving doubts over understanding of the content, facilitating integration in the training action or simply overcoming the isolation that these environments cause individuals and which are a deciding factor in the high drop-out rate of students (Llorente-Cejudo, 2006: 7). Thus a Law and Social Sciences tutor gradually becomes a technical agent, information facilitator, critical analyst of his or her own area of knowledge, study guide, reviewer and evaluator of students' training in an unrestricted and obviously oversized social context (López-Andrés, 2006: 1).

1.3 The importance of competencies training

In this process of change, it is particularly important to adapt the old objective-based syllabuses to competency-based syllabuses. There are many definitions of competency and a variety of perspectives on how it applies to education, which is often a hindrance. Following Lasnier (2000: 315) competencies can mean the complex know-how resulting from the integration, mobilization and adaptation of knowledge, attitudes and skills (cognitive, affective, psychomotor or social) used efficiently to perform certain functions in similar situations. Or following Yániz and Villardón (2006: 21) a competence can be defined as a set of knowledge, skills and attitudes needed to perform a given occupation and the ability to mobilize and apply these resources in a given environment to produce a defined result. In any case and although there is no single definition of competencies, it is agreed they can be distinguished as specific competencies (theoretical knowledge and procedures characteristic of each profession) and generic or transversal competencies which cooperate to perform occupational tasks (Tuning Project 2003: 37; Corominas-Rovira et al., 2006: 307).

Generic competencies

Generic competencies are known by different names and from different perspectives (generic competencies, core competencies, key competencies, transferable competencies, etc.). They describe key, transversal and transferable competencies in relation to a broad variety of life-long personal, social, academic and employment contexts. Generic competencies therefore constitute a fundamental part of the professional and training profile of all or most qualifications (Yáñiz and Villardón, 2006: 24). The main reasons for including this type of competencies stem from the institutions and companies that employ university graduates and demand competency-based training to ensure their human resources have not only technical competencies but also methodological, human and social competencies: that is, human resources with all the competencies related to the ability to act effectively in specific work and life situations in general (Rychen and Salganik, 2003: 189).

In short, generic competencies have the following characteristics (Villa and Poblete, 2007: 24): they are multifunctional and multi dimensional; they are required over a range of important day-to-day professional and social life demands; they are transversal over different social fields; they are not only relevant in the academic and professional sphere but also more generally, for developing a sense of personal well-being; they refer to a higher order of mental complexity; they must favour the development of higher order thinking skill; they must promote the growth and development of the highest possible attitudes and values; and they assume a mental autonomy which involves an active and reflexive approach to life.

Specific competencies

Specialized, specific or technical competencies are related to technical aspects directly linked to the job and are not easily transferable to other employment contexts. Unlike generic competencies they are characteristic of each profession and they give a job its identity, and so they are the characteristic competencies of a qualification (Tobón, 2006: 12).

Specific competencies for students on the fourth year of the Management and Business Administration course include:

1. The ability to manage groups of people.
2. The ability to transmit and communicate in writing and orally using appropriate terminology and techniques.
3. The ability to make analyses and diagnostics, lend support and take decisions on matters of organisational structure, the organisation of work and time and method studies.

More specifically, in this learning experiment we focus on fourth-year students studying management information systems (MIS). The main aim of this subject is in-depth analysis of the organizational and strategic impact of information and communication technologies (ICTs) on business performance. To achieve the subject's general objective, students are provided with two types of content structured in two blocks. The first block provides them with the concepts and preliminary tools for managing information systems and information technologies in the firm. The second block presents real cases of organizations that are successfully managing ICTs and generating efficient and competitive information systems and, in particular, everything related to decision-making on the subject of ICTs and IS (Information Systems), business change management, the use of strategy tools to analyse the opportunities and impacts of ICT and IS in the firm.

ICTs that enable planning, management, marketing and control of products and services have become an essential requirement for any activity. Therefore the “Management Information Systems” subject is intended to provide students with an opportunity to understand and work with these concepts. Companies particularly value information management skills because they provide the basis for correct decision-making.

In both blocks they are taught the specific characteristic terminology and the basic fundamental concepts and processes for managing IS in the company, preparing them to work in this area, in pursuit of the following specific objectives:

1. Ability to analyse and use ICTs in the different areas of a firm.
2. Understanding of the operation, management and control of business information systems in general.
3. Basic understanding of the strategic and organizational impact of ICTs on firms.
4. Ability to diagnose and evaluate the potential of ICTs and IS in organizations.

In the MIS subject ICTs are presented as a real tool for making any change to improve business efficiency and the introduction of ICTs is, in itself, a change.

1.4 Business Process Management: an integrative methodology for competencies training

No change takes place in organizations nowadays without in-depth analysis of their processes. BPM technologies focus on analysing the administration of a firm's processes from start to finish, that is, the convergence of the organization’s management platforms, technologies, collaboration and management applications and business management methodologies which aim to improve productivity and efficiency by optimizing the business processes (Díaz, 2008: 181). Firms and/or organizations are only as efficient as their processes. Traditionally organizations have designed their processes from a departmental perspective. Nowadays, most firms and organizations with a good level of awareness have reacted to the inefficiency of departmental organizations, with their niches of power and excessive inertia to change, promoting the concept of process with a shared interdepartmental focus and working with a customer-focused vision.

Process management is a process-based way of managing the entire organization. Processes are understood as a sequence of activities aimed at generating added value over an INPUT to achieve a result and an OUTPUT, which in turn satisfies customer requirements.

A process must fulfil the following characteristics:

1. INPUTS and OUTPUTS can be described.
2. The process crosses over one or more business functions. One of the significant characteristics of processes is that they can cross the organization vertically and horizontally.

3. It is necessary to speak of goals and purposes rather than actions and resources. A process responds to the question “What” not “How.”
4. The process must be easily understood by everyone in the organization.
5. The name assigned to each process must suggest the concepts and activities it includes.

Process management originated with business process re-engineering (BPR), which emerged in the early 1990s with the consultants Hammer and Champy (Hammer and Champy, 1993: 51) as an option for large companies whose management had become distant from its customers, giving rise to slow bureaucratized processes. BPR focuses on the fundamental reconsideration and radical redesign of business processes to achieve drastic improvements in essential, modern measures such as costs, quality, service and speed, involving a clear break with the previous situation. Re-engineering drastically changes previous processes, it is not a question of doing the same more quickly, but rather in a radically more simple way to give customers the product or service most suited to their needs: the company has to be reinvented.

Re-engineering consists in organizing the company around its basic processes, eliminating all activities that do not provide customers with added value and assigning responsibilities to teams who control the processes. The approach involves (Hammer, 1990: 92-93):

- simplifying processes by not being conditioned by the demands of functional departments;
- making an employee or team with a global vision responsible for an entire process;
- eliminating hierarchical levels because they diminish the need to integrate and solve conflicts between departments;
- enriching jobs as they are no longer limited to the repetitive, isolated execution of an activity (with no understanding of previous and subsequent activities); and
- reducing decision-making to achieve the flexibility and rapid response the market demands nowadays, in other words, bringing decision-making closer to those who perform the work, employees who, as they understand the whole process, do not need to ask bosses to solve a problem.

In short, re-engineering or redesigning processes involves moving away from hierarchical to horizontal organizations, from functions to processes, from authority to self-management, from what is local and uniform to what is global and diverse and from slow and consistent to rapid, changing, entrepreneurial and innovative. It requires knowledge-based team work.

BPM seeks to drastically improve performance by redesigning processes based on ICTs (Teng *et al.*, 1994: 11; Fossas, 2000: 582; Attaran 2004: 19). We use these technologies to teach students to design and model business and learning processes using Aura Portal software.

Aura-Portal software characteristics

Aura-Portal software can be used to model and automate processes without the need for programming skills. This automation also seeks to link processes with the company's other information systems, for example enterprise resource planning (ERP) or customer relationship management (CRM) so that decisions are taken in a guided automatic manner.

1.5 Teaching experiment: a classroom application

The software is applied in the classroom in various stages:

1. Explaining the importance of business process management, providing examples of old and redesigned processes.
2. Explaining the use of ICT as technologies that facilitate the redesign process.
3. Teaching students to model and design processes using the Aura Portal tool.
4. Asking students to visualize the studying and learning of their subjects as a process and to design those processes using the Aura Portal tool.
5. Students learning to automate processes with the tool.

We have currently completed an initial phase with stages 1,2, 3 and 4. We are leaving phase 5 for a future teaching project as it will take longer.

After the classroom experiment we administered a questionnaire to a group of 40 students to collect their impressions. Below we show the main most significant results from the analysis of students' responses:

- 97.5% of students think that accompanying the explanation of process management with modelled examples has helped them to understand the importance of the application.
- All students think that until they used the Aura-Portal software they did not know how to automate processes.
- 95% of students say they have a much better understanding of what a process is, how to model it and how to make it more efficient after applying it to their own learning process.

- 95% of students also thought that what they learnt about this software and process management may be very useful in their future working life.
- 97.5% of students think that this information is very appropriate for the subject. Their reasons for this opinion are as follows:
    - Almost all the students (97.5%) think that the approach made the subject more enjoyable and more practical.
    - 95% think that it gave them a better understanding of the importance of process management in studying the introduction and operation of information systems.
    - 95% also think that studying the Aura Portal software is, in itself, study of a business information system and therefore what they have learnt is useful.

1.6 Conclusions

Teachers in EHEA are responsible for creating new learning environments where students can work autonomously. The use of BPM software as a teaching method enables students on the Management Information Systems course to use a business information system that automates business process management. It is a modern management model used by all firms that incorporate their industry's best practices. This type of methodology emerges as an opportunity for the horizontal transfer and acquisition of knowledge, encouraging students to work autonomously and helping them to acquire competencies which will be useful for tackling a variety of problems throughout their lives.

Students acquire a new perspective for analysing all types of problems, in business and daily life. This perspective enables them to tackle problems such as a set of coordinated activities that pursue an objective which has a beginning and an end and which can be assigned to a person or a group.

The end results of the questionnaire administered to the students are conclusive because they show general satisfaction with this learning experience. In fact, the responses to all the questions are positive in at least 95% of students, that is, 38 students out of a group of 40.

Another perception gained from the questionnaire and informal conversations with the group of students is that when they studied MIS they were not very sure of its practical application in their future professional life. However, after studying the subject, and fundamentally due to the learning experiment, they have been able to observe its utility.

Only one student thought that the learning activity was not very appropriate for the subject, but when asked to give a reason on the same questionnaire, the response was "don't know/no answer."

As a final conclusion, we consider that this experiment has been very useful and we recommend repeating it in this subject, including it as an activity in the teaching guide.

This study has some limitations. Firstly, the group of students was small and classroom learning results are always more satisfactory than they would be with a large group. Furthermore, since this learning experiment was conducted as part of a teaching innovation project, time was very limited. Finally, this teaching project was proposed as a voluntary experience for students. We are aware that this approach may have affected the results.

In terms of future lines of research, as process management is applicable to all the social sciences this experiment could be repeated in other university courses such as employment relations, criminology and tourism, among others. As Management Information Systems is not one of the subjects on these degree courses, this experiment should be included in other subjects in the field of Business Organization. The innovation project has not been completed with teaching on all the features of the Aura Portal tool due to time constraints. As noted in Section 4, stage 5 is needed to complete the entire the process.

Acknowledgements

Research reported in this paper was supported by Universitat Politècnica de València (Spain) Project PIME 2013-A12.

This chapter has been funded by URJC's teaching improvement and innovation project in the area of Business Organization. Project. ""Formación en el uso del software de Business Process Management (BPM) de Aura-Portal para la automatización de procesos empresariales y aplicación innovadora en la gestión del proceso de auto-aprendizaje del alumno"

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CHAPTER TWO

VISUAL SEMANTIC CONCEPTUALIZATION "CONCEPTIPEDIA" A COLLABORATION PLATFORM FOR "WIKINIZERS"

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2.1 Introduction

We illustrate, with use cases supplied by a new personal knowledge organization tool called WikiNizer (wikinizer.com), how visualizing information and its conceptual organization, can help learners and knowledge workers accomplish knowledge organization tasks. The graphic features of WikiNizer, a wiki-like organizer implemented as a graph knowledge base, make visualizations of personal "associative complexes" within shared interests and topics possible, in the form of a Knowledge Graph of "Things". We describe a "Conceptipedia" collaboration concept, applicable not only within the educational field but also in knowledge work in general, which helps us to solve problems visually. Conceptipedia is a collaboration platform which enables WikiNizer users to compare, share, and merge their conceptualization of a domain in the form of meta-knowledge graphs. Conceptipedia helps the user define relations between concepts, and provides interactions which can be coupled with different collaboration techniques. Developing mappings between the meta-structures of the emergent graphs makes conceptualization *intellectually manageable,* and turns semantic structures into visual Knowledge Architectures that consolidate ontological relations. The collaborative epistemology of Conceptipedia co-evolves commensurate meta-structures to the mutual benefit of its users. Sense-making, by researching, exploring, capturing, articulating, mapping, visualizing and merging conceptual (meta)-structures and relationships can become a social process of consensus building.

Keywords: Intelligence Augmentation, conceptualization, collaborative knowledge management, knowledge architecture, visualization, Wiki, WikiNizer, Conceptipedia, experimental epistemology, personal digital archive, bootstrapping.

2.2 Visual knowledge organization with WikiNizer

In an earlier paper we spelt out our vision of what a “Next generation concept organization tool” should accomplish (Benedek and Lajos 2012). We sought to empower knowledge workers by taking a system oriented approach to the development of a personal knowledge organization tool called WikiNizer, (wikinizer.com). WikiNizer is a visual-wiki like, computer enhanced knowledge management environment, built in a new holistic way (Lajos and Benedek, 2013) designed to help us develop and visualize our conceptualizations as we pursue sense making. WikiNizer empowers individual knowledge workers in their efforts to integrate web research, bookmarking, digital archiving, note taking, brainstorming, (free/reflective) writing, linear breakdown and non-linear wiki-like linking and elaboration, slide generation et al, into a common platform. It gives knowledge workers what they need as they attempt to seek, record, make sense of, structure, interpret, and represent, knowledge within an integrated goal focused end-to-end workflow. As a graph based knowledge management tool WikiNizer adds new visual and semantic capabilities to wiki like knowledge organization. Its graph based knowledge organization uses atomic nodes and edges which form a class hierarchy.

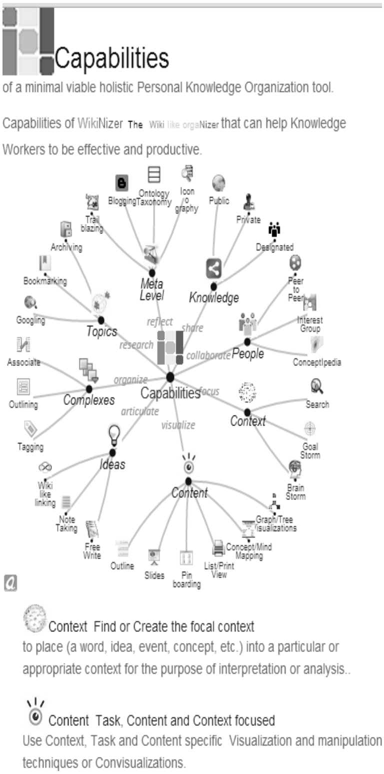

Fig. 2-1. CMap of WikiNizer's Capabilities in Radial Tree View

Fig. 2-2. Rearrange the pages in Outline View *via* Drag and Drop

Fig. 2-3. Dynamic, auto-revealing, auto-cuing Slide Show

The root class is Page with a Title, Stub, Label and Body. Everything in WikiNizer is built on this foundation. This universality enables task focused visualizations of the same content in the variety of ways which meets your needs. Instead of WYSIWYG – **W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **G**et (and "yeah, but that's *all* you get") (Engelbart, 2004) – you have **W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou ***Need*** (WYSIWYN). For example, when working on a topic, a brainstorm can span a hierarchy of sections and paragraphs, with each paragraph having its own title, and its stub giving you a short summary of the intention of the paragraph. You can visualize it as a Tree or Concept/Intent Map (intentmap.org/) (Fig. 2-1.). You can rearrange the pages in an Outline View with Drag and Drop, and do likewise with all the connected nodes (Fig. 2-2.). At any time you can see just the text that can be extracted into a Read View. Content can be presented as a Flyer, showing sub pages as list items, where the icon for the subpage is shown together with the title of the page and its stub. The same content can be animated as a dynamic, auto-cuing, auto-revealing, Slide Show presentation, generated from the content of the Concept Map. (Fig. 2-3.). In Navigation View (Fig. 2-4.), along with the text, the titles and stubs for every page are shown allowing the switching back to Tree View, Editing, etc. Since every page/paragraph is an entity with an ID, it is possible to construct more complex “virtual pages,” “trails” and other special purpose Knowledge Architectural Components.

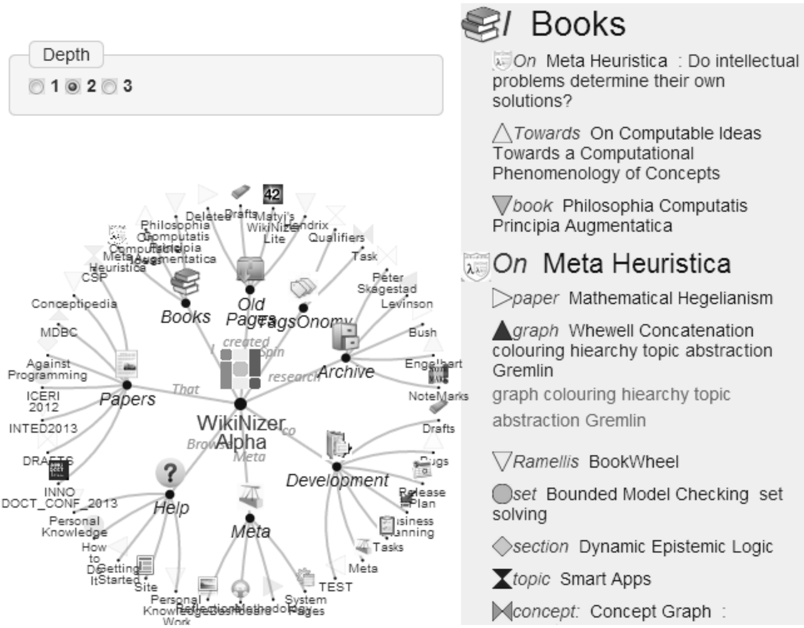

Fig. 2-4. Zooming on the “Books” node (Depth 2) in Navigation View

At the meta level WikiNizer enables the user to construct the structures which conceptualize the particular domains of interest. Sharing the conceptual structures that emerge in the problem solving contexts which web linked personal knowledge supplies requires a common representation of concepts and related data. The collaborative use cases that WikiNizer generates create a “reference model” of graph based visual concept organization which we have called a Conceptipedia. (Benedek, Goodman and Lajos 2013). In Section 3 after discussing the impact of visualization on conceptualization, we indicate our use proposals.

2.3 Significance of visualization for knowledge organization. The externalization of concepts and their relations

There is growing evidence that visual conceptualization takes place in non-human, even non-mammalian animals. There is quite a distance however from mental representation, or internal enactment of conceptualization, to objective presentation or inter-subjective expression of concepts and their relations. The Parry-Lord thesis (Goody and Watt, 1962), that the structure and texture of our thinking relies upon our recording and information organizing technology, can be applied to visualization techniques as well as language recording tools such as the alphabet. Visual objectification not only renders fleeting thoughts more enduring; with re-perception facilitating additional inspection and re-consideration, shared technologies also help to create shared interpretations. Visual organization structures the conceptual content of our linguistic articulation into spatial, graphic and iconic symbolic expressions of our knowledge organization.

Advantages of visual knowledge architectures for conceptualization

Visualizing conceptual relations has the potential to generate a “Cartesian” knowledge organization system. A conceptual system binds together three constituents of conceptualization: (1) *clustering* (collecting, associating, grouping, classifying) *content* on the basis of intra-class and external relationships; (2) *identification, individualization or delineation of clusters* (naming, iconizing, and standardizing for the sake of symbolic identification by the discovery of characteristic features, patterns and parameters); and (3) the *presentation of external relations* (links, aspects, colligations, connexions, correlations, and relationships). Visualization of conceptual relations requires a technology which can present them in a conceivable way. Visual tools help us explore complex conceptual relations and meanings, including program structures. Domain knowledge can be represented and visualized as systems of conceptual categories constrained by the nature and purpose of categorization.

With the advent of digital media, models which take problem solving to be a linear, stepwise process have been left behind by Visual Programming Languages, UML diagrams, linked hypertexts, visualizations of non-linear narratives, concept maps and graph-based and topological representations of conceptual spaces. In what could be described as an “Engelbart Galaxy,” in which collaborative bootstrapping promotes augmented problem solving (Engelbart, 1962), we can edit video on-line, create info graphics, make use of various forms of visual cartography, and advance towards the development of ever more elaborate non-linear visual knowledge architectures. Topic maps can incorporate a variety of different forms of textual and visual e-content, and also serve as a means of structuring and navigating knowledge. Visual logics are e-didactic tools which increasingly are used to design a learning experience. In an educational environment these tools can remove the constraints of predefined paths in the learning material, and encourage students, teachers and researchers to discover novel relations which better fit their epistemic needs. Designing visual knowledge organization environments with task specific modules which support new Human Computer Interactions based strategies of conceptualization gives us the cognitive potential for collaborative problem solving. Our initial experiences with WikiNizer confirm that this potential can drive a range of "augmentation engines" which answer the intellectual challenges of the new Web 3.0 period of the "second media age" (Carbo et al. 2013), not only in learning contexts, but also in the field of scientific research and effective knowledge work.

Dynamism and cognitive flexibility of visualizations

Digital media provides new ways of representing and transferring meaningful information. Spiro and Jehng note that a hypertext and non-linear and multidimensional traversal of complex subject matters supports cognitive flexibility as they adapt to semantically rich, dynamically changing knowledge representations. "By cognitive flexibility, we mean the ability to spontaneously restructure one's knowledge, *in many ways*, in adaptive response to radically changing situational demands [...] This is a function of both the way knowledge is represented and the processes that operate on those mental representations" (1990: 165, emphasis ours). Reorganization, intellectual manageability, and cognitive flexibility require more dynamic forms of knowledge representation. The "knowledge augmentation engine" we are proposing (Lajos and Benedek, 2013) is a visual knowledge organization tool which helps us, through meta-design processes, to build conceptual meta-structures that co-evolve with knowledge organization. Visualizing interactive problem spaces in the form of conceptual graphs enables problem framers to play a more active role in defining the problems to be solved, and further visualization techniques render cross-interdependence between conceptual domains comprehensible. These learning ecosystems can be bootstrapped to integrate visual and verbal representations.

Amalgamation of textual and visual knowledge organization

Multimodel Web Scale Graph databases, and the multimedia capabilities of HTML5, give us the possibility of creating new “amalgamated” forms of visual and textual presentation:

1. Visual tools can organize and structure semantic information (textual as well as visual or auditive).
2. Textual/hypertextual structures can incorporate visual or multimedia presentations of audio-visual information.

An example of the first option is a concept map which visually organizes textual information, and its relations, but a UML activity diagram also belongs in this category. With regard to the second, articulation, exposition and framing of textual information is complemented with visual information and is composed of multiple media. Hypertexts, and HTML5 based learning, and knowledge transfer environments, fuse visual, audible and complex perceptual experiences into integrated digital environments supplying inter-subjective and objectively reproducible records of sensory experience, not just text with illustrations. They have meta-structures which can be reproduced as templates or microformats (microformats.org). These formats can be seen as abstractions of the hypertextual structures (or “textures”) of the information organization. These meta-structures can be described as augmented Cyber-textual knowledge architectures. (Benedek and Sándor, 1999).

2.4 Conceptipedia as a tool of collaborative conceptualization

How knowledge domains are visualized impacts upon the efficiency of conceptualization and collaborative problem solving. Real life problem situations rarely have a linear character, and their conceptual relations are often difficult to describe using words. When collecting and organizing information, labelling and abstraction help us comprehend and structure the relationships between the various components of a problem. These relationships are often expressed using labelled graph structures. They disrupt the linearity of lists and strict concatenation and admit non-linear dimensions of visual organization. Visual graph representations, such as node-link representation in Hypergraphs or TouchGraph can be viewed as externalizations of the cognitive associations which precede our conceptualizations. Cyber-textual knowledge architecture uses computers to enhance knowledge capture, elaboration, linking and organization, amalgamating the visual and the textual components in graph structures, Web Apps, live HTML5 and video editing, in order to facilitate the articulation of concepts. Within such a wide range of Digital Content Creation new meanings are generated, and they not only express and externalize concepts, but also visualize their relations.

The graphic features of WikiNizer make visualization of personal "associative complexes" possible in the form of a Knowledge Graph of "Things" which are amenable to interpretations defined at a meta-level. Conceptipedia supplies us with an intellectually manageable visual organization of conceptual relations, and abstracts their meta-structures in the form of externalized meta-class hierarchies. On the grounds that novel meanings and conceptual relationships emerge as a consequence of social interaction, we offer Conceptipedia as a public "Forum" in which, with computer support, the conceptual meta-structures which emerge from specific problem domains can be exchanged, mediated, integrated, and collaboratively developed.

Using Conceptipedia as a Cloud based Co-operative Framework for Personal WikiNizers opens up the possibility of turning WikiNizer from a personal knowledge organizer into an augmentation engine of collaborative conceptualization (Lajos and Benedek, 2013). Because it is conceived as a graph of "Things" which enable relations between concepts to be defined within a meta-knowledge graph, it can be used by WikiNizer users as a collaboration platform that enables us to compare, share, and merge emerging Knowledge Architectures in a wiki-like collective graph knowledge base. WikiNizer supports collaboration in small teams, and can be coupled with Conceptipedia to build Knowledge Graphs that can be used interactively to define aspects and novel relationships between concepts and things via Collective Semantic Conceptualization. By developing mappings between meta-structures this concept adjusting service renders conceptualization intellectually manageable, and transforms underlying semantic structures into Knowledge Structures which consolidate ontological relations. It enables teams which collaborate on emergent Knowledge Architectures to share and compare conceptual structures. Sub graphs can be categorized by labels, "aspects" and types of relations, and user groups can apply coloured relations, where colours can represent agreed upon types of relations. In this way sense-making can be turned into a process of consensus building that facilitates the researching, ingesting, exploring, capturing, articulation, mapping, visualization and merging of conceptual meta-structures and their various relationships. Interactive operations open the way for comparing, selecting and merging conceptual structures, both at the object and the meta level, supplying us with visual tools for semantic collaboration.