

Effective Authoring Procedure for E-learning Courses' Development in Philological Curriculum Based on LOs Ideology

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Abstract. An efficient model of hyper textual authoring processes and guidelines for electronic multi-media educational and scientific resources' development in Philology is being discussed. The model was successfully applied for construction of the interactive hyper-media e-learning Web-resource "Russian Dialectal Phonetics". The electronic public educational and research resource in Russian Dialectology is the first and unique one fully based on SCORM ideology. Basic authoring algorithms were adopted from the object-oriented programming (OOP) and Rapid Application Design (RAD) ideology and practice for application. The e-course comprises two major components: a theoretical overview and practical sections (on-line self-tests, exercises). An interactive glossary of linguistic and other special terms is also appended through the network of hyperlinks. As essential multi- and hypermedia product the course comprises texts, image illustrations (dialect maps included), authentic dialectal spoken language recordings from the archive of dialectological expeditions.

Keywords: e-learning resources, hypermedia authoring principles, SCORM, Russian Phonetics, Russian Dialectology.

1 Introduction

Any national or international modern system of education is now facing three global imperatives generated by the new – computerized – era's challenges in the domain of educational technologies' development. They are: (1) openness of educational institutions; (2) accessibility of the individually tailored education (anytime – anywhere; on-demand; just in time); (3) continuity of the personal learning's processes – life-long learning. Openness of the educational space provides equal possibilities to every member of a human society to become educated in a certain chosen field/area. Accessibility of education – "anytime – anywhere" – is of special importance for countries with big territory and dispersed population. Continuity, or life-long learning is tightly related to a constant development and changeover in information technologies being today a key source of modern world's transitions. Investigation and understanding of the passage of educational interactions from a real world's natural communication patterns and models to a virtual communication environment is crucial for understanding and adopting the

latest progressive trends operating today all the modern educational processes. Thus, a problem of “computerizing”, or “virtualizing” educational resources has become of common primary concern.

The technology of e-learning resources authoring is tightly connected with a new concept of e-learning materials (electronic manuals, e-assessments, e-libraries and other e-learning resources – for example, data bases and corpuses). And here a new fundamental concept in Educational Technology: a notion of “learning object” (LO) [1] comes to the front.

Learning objects, as defined by the IEEE's Learning Technology Standards Committee, are “any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning” [2]. Generally, the learning object model could be characterized by the belief that one can create independent chunks of educational content that provide a certain educational experience for some pedagogical purpose. Based on the object-oriented programming (OOP) model, this approach asserts that these chunks are self-contained, though they may contain references to other objects; and they may be combined or sequenced to form longer educational interactions. These chunks of educational content may be of any mode (interactive, passive) and of any format or media type. Main benefits of LO approach to education content authoring is usually defined as so-called RAID package (Reusability, Accessibility, Interoperability, Durability) [3].

The main problem of the worldwide educational community at the moment is that there are no commonly acknowledged and adopted guidelines for effective learning objects' authoring hitherto. Therefore, any significant “lessons learned” from various latest experiences in e-learning materials' authoring, production and dissemination are not incurious and could be of some practical importance. Thus, some basic ideas and practical algorithms, tested within an international project of development of the interactive hyper-media e-learning Web-resources “Russian Phonetics” and “Russian Dialectal Phonetics”, are presented for discussion below.

2 Theoretical Background

It's well known that the most significant challenge in LO-based approach to e-learning materials authoring is a problem arising from the fact that the reusable learning objects represent in many ways an alternative approach to educational content development. This approach could be characterized as a certain dualism in information processing procedures. On the one part, an educational content needs to be fragmented into meaningful “chunks” irrelevant to their size, physical nature and perception mode. From the other part, taking into account the pedagogical perspective, each “chunk” must play a specific role within a certain instructional design methodology. Linkage of these two concepts is often considered as path to successful e-learning resources' authoring and application.

An efficient and promising approach to the problem could be adopted from a software logic engineering practices [4]. From a certain perspective, an online course might be considered as another program application, therefore educators would need to apply design techniques already well-known in the software industry, and in particular, that of Rapid Application Design (RAD). The application of RAD for software development allows a designer to select and apply a set of predefined subroutines from a menu, or

selection set within a certain programming environment. Thus, an e-learning course, viewed as a software entity, may be also considered as a collection of reusable subroutines and applications. Simultaneously, an online course, viewed as a system of learning objectives, may be seen as an ordered set of reusable learning materials. It is supposed that merging these two concepts, i.e. conceiving of reusable learning materials as reusable subroutines and simultaneously as reusable pedagogical applications, is a keystone of any successful e-learning resources' authoring activity.

Another productive concept, we would like to offer for adoption from the software programming theory and practice, is the notion of object-oriented design elaborated within OOP theory [5]. The core idea in object-oriented design is that of reproduction, or "cloning": prototypical software entities, once defined, could be easily cloned, and used as a piece of software when and where needed.

3 Authoring Practice and Guiding Principles

We have tried to apply the both mentioned above basic approaches to the construction of e-learning course of Russian Dialectal Phonetics on the Web [6]. The open-source electronic public educational and research resource in Russian Dialectal linguistics was programmed as the pilot one based on SCORM ideology in the field. In the functional perspective the course's structure comprises two major components: (1) a comprehensive theoretical overview of the domain, and (2) interactive practical sections (on-line self-tests, exercises, etc.). An interactive glossary of all encountered in texts linguistic and other special terms should be also provided through the dense network of hyperlinks. As essential multi- and hypermedia product, the linguistic e-course normally encompasses information in various perception modes: texts, image illustrations (dialect maps included), authentic dialectal spoken language recordings. According to the pre-planned authoring procedures a "crude" course's general prototype has been defined beforehand, and a specific e-learning course (namely, e-learning Web-manual of the Russian Phonetics [7]) has been created online using prototyping and cloning ideology. In the previous authoring activity we have tried to formulate some more detailed precursory parameters of a linguistic course-prototype (for more details see also [8]). It is worth mentioning that since the year 2001 these presuppositions have been evaluated through practical use of the Russian Phonetics e-course in various distant education programs of teaching and learning Russian linguistics. This project being one of the most successful and proven as an authoritative source on the subject by Wikipedia, has initiated a series of similar educational and scientific e-resources both in Russia and worldwide. Therefore, we were encouraged to apply the same procedures and programming patterns, though revised and re-developed according to new theoretical concepts, in construction of the original educational and scientific Web-resource on the Russian Dialectal Phonetics.

3.1 Course Prototype Structures

Designers of computer interfaces have already long ago understood that the starting point of any good interface design – that is user-friendly and corresponding to users' intuitive layout schemes program interface, should be a metaphor. The metaphor

principle demands that both monitor screen layout and basic means of interaction with the computer system should appeal to a situation familiar to the user.

The metaphor principle determines many other valuable parameters of the hyper-text design providing information integrity, information consistency and information density. Various aspects of the underlying metaphor could help to outline a formal system of all basic interaction patterns at the earliest stage of designing processes, and to determine thus an inventory ('alphabet') of reusable design elements, each of them being assigned special, context-dependent function and meaning. Normally the system of reusable design elements should coincide with system of basic LOs prototypes. This approach has proved its unique efficacy in construction of vast Internet-portals, normally containing hundreds of interconnected Web pages, each of them enriched with multimedia and hypermedia information.

To outline a hierarchy of LOs prototypes one needs to classify and categorize basic constituents of the whole semantic space of instructional content keeping in view their didactical roles. It has become already a common sense statement that any online learning content typically contains:

1. Text, sound, graphics, and (optional) movies;
2. Controlled (interactive) graphic and animations [9];
3. A navigation facilities (a scheme, a table of contents and/or buttons);
4. Drills and self-assessment facilities;
5. Assessments and evaluation forms;
6. External/internal hyperlinks.

Thus, a *prototypical lesson* in our course of Russian Dialectology consists of:

- Text properties of two principle kinds (title, paragraph);
- Sound illustrations' properties (for dialectal / standard speech digital recordings' import);
- External / internal (cross-reference) hyperlinks' properties (glossary entries included);
- Graphical illustrations' properties (for sonogram, oscillogram, intonogram, scheme, etc. import);
- Animation (video) illustrations' properties (for simulations and videos);
- Exercises of two principle patterns (self-assessments and control tests).

When an informational "chunk" (a lesson) prototype should be defined for the first time, it makes no sense to specify for this prototype alone each and all of the above listed properties. Rather, what happens in object-oriented design is that the most basic prototype is constructed first – for example, in our case, in a *Lesson prototype* – the most generic *Title & Paragraph & Illustrative media & Hyperlink* prototype, or in a model *Exercise prototype* – the most generic *Question & Answer & Check box* prototype. An internal (external) hyperlink prototype inherits more general hyperlink properties, but has a special value: it is targeted to internal data base subroutine (in our case a *Glossary*), or an URL.

Then, the next more detailed prototype, for example, a *graphics'* prototype is defined. The *graphics* prototype "inherits" the *lesson* prototype; that is, we say that all the properties a *lesson* can have, a *graphics item* can have as well. Thus, when we

create the *graphics* prototype, we need only to create – to add-on those properties and behaviors that are unique to graphical illustrations. And so this defining continues on down the hierarchy.

When we create a *scheme* prototype, we define a *scheme* as inheriting all the properties of a *graphics*, and define only those properties that are unique to *scheme*. Thus programmers can quickly and efficiently create a new type of entity – a special class of illustrations, for example, a new sub-class of *graphics* (Dialectal maps, for example) – by simply inheriting the necessary properties from more generic entities.

A sample *Lesson* page with marked prototype attributes for menu bars, text, audio, video, image items, exercises and self-assessments, as well as referential and cross-referential links is exposed on Fig. 1.

A sample *Lesson* page with marked prototype attributes for *graphics* exemplars is exposed on Fig. 2.

Learning object prototypes may also define prototypical actions or behaviors for their clones. For example, a behavior we might expect from a student doing *self-assessments*, or *control tests* is to click the right answer (for multiple answer question type assessment) and to push the re-do button (or activate any similar icon facility). The assessment prototype has this behavior predefined as a function; when a clone is created – for example, a multiple answer control test, it comes complete with this behavior. Hence, we can make our clone do things by referring to these predefined functions.

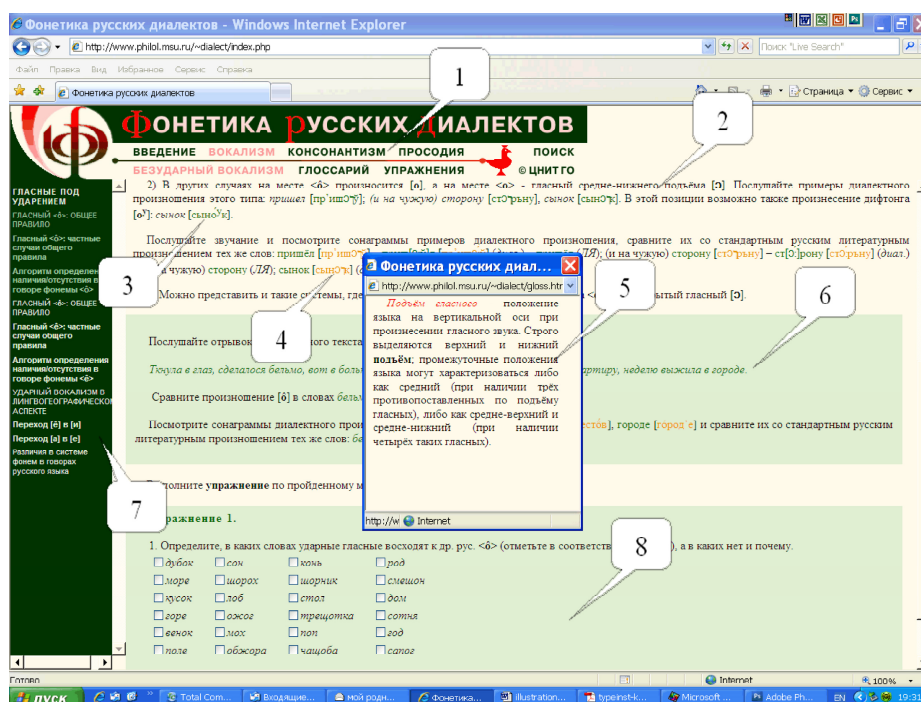


Fig. 1. Lesson sample page with LOs' marking: 1 – Modules' menu bar; 2 – Paragraph; 3 – Sound speech example; 4 – Sonogram entry link; 5 – Glossary entry window; 6 – Exercise; 7 – Lessons' menu column; 8 – Self-assessment activity

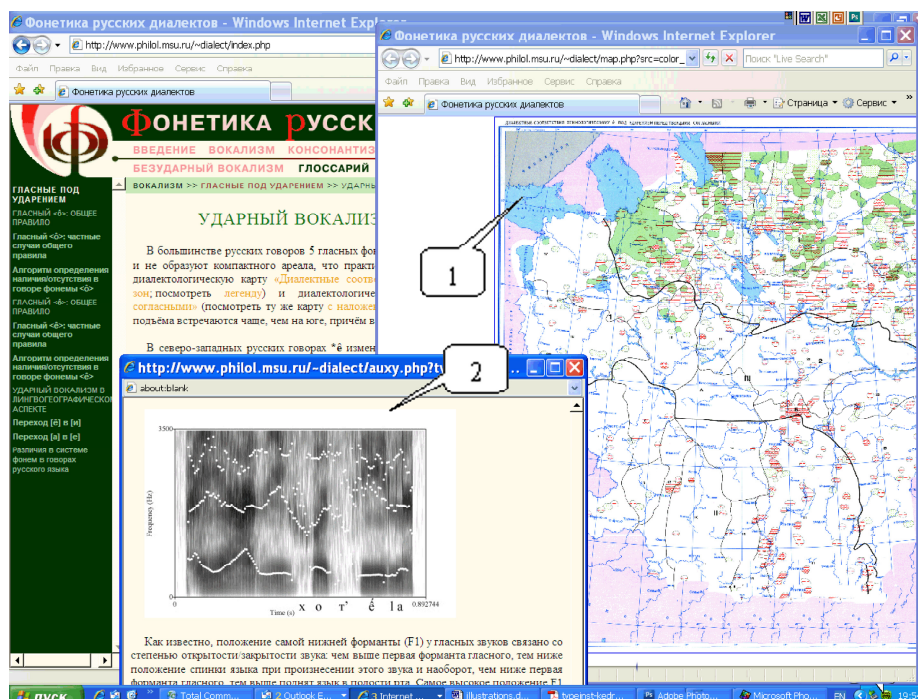


Fig. 2. Lesson sample page with Graphical illustrations' patterns: 1 – Dialectal map window; 2 – Sonogram illustration window

Objects may interact, or more generally, be related to each other, in many ways. The most useful and common form of interaction is the containing interaction. The course comprises modules, into which lessons were encompassed as another learning object. The containing interaction of the LOs' represented in their *titles* (or *metadata*) taken in hierarchic order, forms navigational menu's prototype(s). Thus, a well-ordered sequence of navigation interactive keys could be fast formed quite automatically, according to the author's current intentions for educational content's granulation and (re)structuring.

Another type of interaction is a hyperlinked association either with external objects (to other web-sites, for example), or to internal objects – cross-references and links to the Glossary items' list (see Fig. 1-5).

3.2 Course Design Requirements

The LOs-based approach has proved its unique efficacy in construction of vast Internet-portals, normally containing hundreds of interconnected Web pages, each of them enriched with multimedia and hypermedia information. It is important to emphasize that the latter capacities require additional special designing patterns and procedures, while psychology research in human perception has revealed that activation of any new perceptive modality – a new perceptive experience (for example, dynamic, animated, or sounding objects incorporated into a text fragment or placed inside graphic

elements, and vice versa), would disturb continuity of perceptive processes, dissipate user's attention and could thus produce strong distracting effect in general. Therefore, correct *design* representation of conventional (textual) and/or multi- and hypermedia LOs (i.e. text, image, animation, video and sound mixture) is the key element for adequate information processing, as well as for preserving psychological safety and stability of user, as well as her/his mental comfort. Synthetic nature of the hypertext's perception and non-linear processing procedures impose special demands to semantics of the color palette for every LO, harmony and conformity of a color scale on a page and throughout the whole Web-site, significative balance of hyperlinks' color markers and corresponding LOs: sound, image, animation, or video-clip palette, etc.

Within the both e-learning resources it's the meaningful interplay of all organizing and designing features (i.e. logo and navigation bars, background colors and text character palette, font type, general text formatting schemes, format of hyperlink markers, etc.) that play special role and function to mark various LOs, and their interaction patterns. Worth to add that aesthetically the overall color palette of the Web site should also be thoroughly harmonized within the general Web-page layout, as well as across the whole set of Web pages embodying certain information hyperspace.

These principles of the Internet design should be also based on the current LOs inventory and content structuring, enabling therefore to 'melt' text and multimedia elements into a perfect whole either within an integrated communicative message on a single Web page, or across the pages on an Internet-site. Only the systematic integrity of the kind allows to reach such information and aesthetic value when all consists of everything, every constituent is in harmony with the other ones, any new element could be easily built-in into the whole comprehensive structure and would get support from other elements of the system [10].

4 Results

Nowadays we state that the above described theoretical assumptions and elaborated within the project's activity practical algorithms have proved ever since its effectiveness in time- and labour-savings. Below is some numerical data of the estimated size of the Web-site e-learning resource "Russian Dialectal Phonetics", which has been authored in accordance with the above-described principles within the time period of two years. Currently the site consists of:

- 57 presentation chapters (in 4 main modules);
- 212 contextual as well as separate interactive and multimedia self-assessments' modules;
- 122 control integrative interactive multimedia tests;
- 2090 speech illustrations (sound-) files;
- 515 graphic illustrations (image-) files;
- 52 interactive dialectal maps;
- 57 sonograms;
- 161 glossary terms with definitions.

As an open-source product elaborated upon detailed study of the most effective SCORM-technologies and appropriate ideology, the e-course "Russian Dialectal Phonetics" could be further enlarged and outspread to other levels of linguistic description of the Russian dialectal system, i.e. morphology, syntax, lexicology, etc. Thus, our results endorse an assumption of the effectiveness of the technologically based approach to LOs' construction and application. As Stephen Downes wrote in [4]: "Courses developed along previously used models – the Bates model in the first hand – were expensive because of two major (and related) design features. First, all course material is created from scratch, and second, this material is applied only to the limited number of students taking this particular course. In order to lower costs, therefore, a course development program must enable educators to avoid creating everything from scratch, and to allow created course content to be applied to a much larger number of students". The elaborated authoring practical guidelines and recommendations could be considered as a convincing example of these principles' efficiency.

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