

The Method of Design of Electronic Advanced Training Courses for the Development of Information Competence of the Teacher

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Аннотация

The article deals with the actual problem of the development of information competence of a teacher in the design of electronic advanced training courses. The choice of the research topic is due to the contradiction between the rapid digitalization of all spheres of human activity and the current level of formation of the information competence of the teacher in the design of electronic courses. The key components of the developed model of designing electronic training courses and the structural links between them, the principles and didactic functions of the course being developed, the stages of designing an electronic course corresponding to the developed model are considered. Results: the proposed methodology for designing electronic advanced training courses, including the external design stage and the stage of work on the technical task. Conclusions: it is shown that the important stages in the creation of electronic courses, developed on the basis of the proposed model, are the stages of external design and technical tasks. Knowledge of the design sequence of the e-course, the principles and functions of its construction will significantly affect the quality of the product being developed and must be taken into account to improve the system of advanced training of teaching staff.

Keywords: electronic courses, methods of designing electronic courses, information competence of the teacher, teacher qualification improvement, external design, technical task.

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1 Introduction

The rapid pace of development of all spheres of activity of people, caused by the large-scale introduction of digital technologies, has led to the fact that any specialist needs to widely use them in their professional activities. The functions and roles of the teacher and, accordingly, his professional training are transformed. From the knowledge carrier and controller, the teacher turns into a tutor, mentor, consultant, navigator in the world of information, a moderator directing and initiating active work, organizing various types of interaction of students, an expert and a developer of electronic educational materials. With the immersion of learning activities in the conditions of the digital educational environment, the functionality of the teacher will be expanded. Now the teacher should be ready to perform such functions as:

- preparation of teaching materials in a digital format, the exchange of these materials with colleagues in an educational organization and beyond;
- encouraging schoolchildren to study in different conditions: at school, outside of it, in a real and virtual (online) environment;
- study of the possibilities of these environments for the organization of various forms of training;
- mastering new tools, means and forms of organizing educational and cognitive activity of students;
- active participation in group work, professional associations, communities, forums, teachers' cooperation in their educational organization, region, country and internationally.

2 Problem Statement

Surveys of educators suggest that many more of them do not have experience in the Internet space, do not possess the tools and means of the information educational environment, the skills of communicative work in the forum, blog, chat, do not use the modern arsenal of computer-aided learning material for studies, for the organization of control and assistance to students. This can be caused by:

- the lack of understanding by teachers of modern trends related to the digitization of all sectors of the country's economy, the requirements for modern education and the graduate profile;
- ignorance of new ways of searching and presenting the necessary educational information;
- insufficient possession of Internet technology tools for the selection and design of electronic educational materials;
- the lack of knowledge about the design of classes, taking into account the capabilities of the information environment of the educational organization (common information educational systems, teacher's and students' training, online learning opportunities, etc.).

Analysis of the trends of modern education, as well as the study of issues of the development of information competence (ICT competence) of teachers revealed a number of contradictions:

- between modern trends related to the digitization of all spheres of the country's economy, the requirements for modern education and the graduate profile and the insufficient willingness of teachers to use Internet technology tools and modern tools of the information educational environment;
- between the variety of elements and possibilities of the information educational environment and the insufficient information competence of teachers, which does not allow using these opportunities;
- between the proposed significant number of refresher courses related to the development of information competence of teachers and an insufficient number of courses developing the competence of teachers in the design of electronic courses.

The mentioned contradictions initiate the main **task** of the research: to propose a methodology for designing electronic advanced training courses in the field of information competence of a teacher, including the external design stage and the technical assignment stage.

3 Development of methodology

3.1 The essence of the concept of "information competence of the teacher"

In the 21st century, the teacher is no longer just a source of knowledge and skills, he is actively involved in the formation of a new, informational type of society. It should be an example for students in the constant striving to update knowledge, in mastering modern technologies, in developing theoretical and practical thinking and creativity. Now the main task of the teacher is to prepare students for life in a modern information society, in which the main values are knowledge and information, as well as the ability to work with them competently. To do this, it should form the information competence of students, which will be one of the factors of successful

socialization of the individual, and will also ensure mastering the methods and means of collecting, accumulating, transmitting and processing information and knowledge throughout a person's life. Information competence is an integrative quality of a person, which is the result of the reflection of the processes of selection, assimilation, processing, transformation and generation of information into a special type of subject-specific knowledge, allowing to develop, adopt, predict and implement optimal decisions in various fields of activity [Tris04].

The structure of the ICT competence of the teacher is determined by the developments of the International Society for Technology in Education ISTE [Inte18] and the UNESCO Institute for Information Technologies in Education (IITE). The recommendations of the UNESCO IITE [Stru11] were taken into account when developing the professional standard "Teacher"[Stand13] and in many respects meet the requirements of the framework recommendations on the structure of ICT competence of teachers (UNESCO ICT Competency Framework for Teachers (ICT-CFT), which are based on the triune matrix competencies of teachers in the professional, social and ICT fields. These recommendations take into account that the modern teacher provides not only fundamental training in his subject, but also with the help of ICT tools he develops be to learn and acquire knowledge.

Thus, in our study, we adhere to the following concept - "Information competence of a teacher - his readiness and ability to independently use information and communication technologies in his professional activity" [Gorb04].

3.2 Model of designing advanced training courses for the development of information competence of teachers

We have presented a spatial understanding of the design of advanced training courses on the development of ICT competence of teachers (Fig. 1):

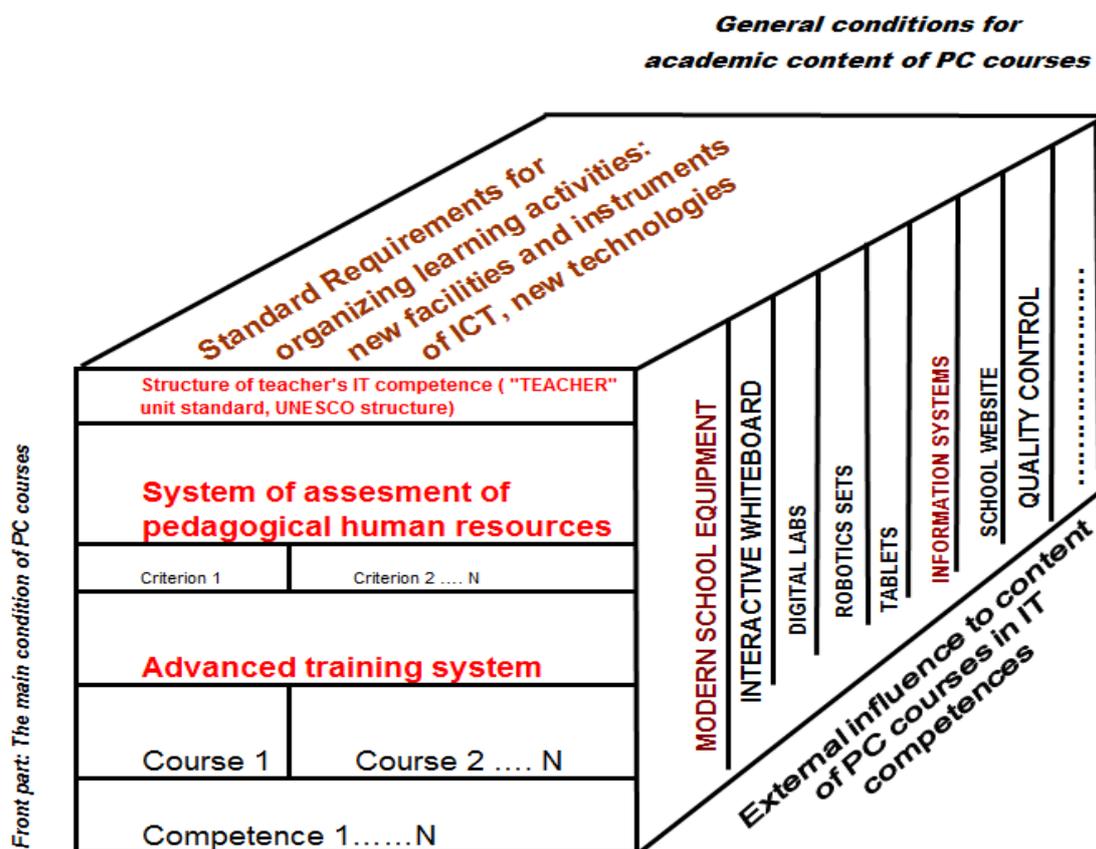


Figure 1: Design model of advanced training courses for the development of ICT competence of teachers

The front part of the model. The UNESCO Institute, together with leading experts in the field of informatization of education, has developed international recommendations containing requirements for the

ICT competence of teachers, entitled “UNESCO’s ICT Competency Framework for Teachers” . Teachers who meet these requirements are able to successfully carry out the educational process in an ICT-rich educational environment. The structure of the teacher’s ICT competence is represented by the following sequence: “ICT application” (assisting students in using ICT to improve the efficiency of learning activities); "The development of knowledge"(assisting students in the development of subject content and the subsequent use of the knowledge gained in solving complex problems, the surrounding reality); "Production of knowledge"(assisting students in the production of new knowledge that is useful for the society around them). The considered approaches characterize the stages of the process of informatization of education and the professional development of teachers who improve their skills in an ICT-rich educational environment: hardware and software ICT, organization and management of the educational process, professional development.

According to the professional standard “Teacher” , the teacher must master the following types of ICT competence: general user; general pedagogical; subject-pedagogical (reflecting the professional ICT competence of the relevant field of human activity). Moreover, each type of ICT competence has many indicators characterizing the labor functions of a modern teacher in the information educational environment.

The identified ICT competencies from the teacher’s professional standard and the structure of UNESCO’s ICT competencies are reflected in certain indicators and criteria of ICT competencies in the register of additional professional programs for advanced training courses for the information base of the pedagogical personnel certification system. Further, a regional training center makes a request for relevant advanced training courses that form one or another ICT competence, and the teacher himself must have access to the register to select the course he needs.

The essence of the horizontal plane of the model: the main condition is that the content of refresher courses meet the requirements of the Federal state educational standards for the organization of educational activities. This means that it is necessary to use the methodology for working with new tools and tools for learning activities, to organize new forms of learning interaction in the network, to apply integrated educational technologies. Therefore, when designing advanced training courses on the formation of ICT competencies, teachers need to incorporate into their content pedagogical and information technologies that allow them to organize new types of educational activities. One type of such activity can be a network activity of a teacher and a student [Zen18].

The essence of the profile plane of the model is reflected by external factors, such as the use of innovative equipment in schools (interactive whiteboards, digital laboratories, robotics kits, tablets for working with the electronic form of a textbook). The content of advanced training courses should also be focused on the effective work of teachers in information systems.

At the same time, at the present time, teachers go beyond the usual limits of their professional activities and are included in the work on the development of new technologies for organizing the educational process:

- develop methods of working with modern tools of educational activities;
- master new organizational forms of educational interaction in the network (network services; specialized software; methods of educational interaction in forums, webinars, chats; work with the electronic form of a textbook, etc.);
- offer their own approaches to the use of integrated educational technologies (blended learning, inverted class technology, gamification, screen casts, workshops, etc.).

The integrated and reasonable combination of the above conditions and factors will allow a more holistic and comprehensive approach to the design of advanced training courses on the formation of ICT competence of the teacher [Zen17].

3.3 Conceptual basis of the design methodology of electronic advanced training courses for the development of ICT competence of teachers

In the process of designing electronic courses for teachers’ advanced training, it is necessary to have clear guidelines in the form of principles for constructing the methodology and pre-planned didactic functions of the course being developed. In addition, when designing courses, it is necessary to take into account the requirements of the Federal State Standards at various levels [Stand17], the Professional Standard "Teacher"[Stand13] and other documents, as well as possible conditions for the practical implementation of the training course and conditions for further work activity of students , methodologists, leaders of educational organizations, etc.).

When developing a methodology for designing an e-learning course for teachers, aimed at developing ICT competence, one should be guided by the following *principles*.

1. *The principle of functional completeness* of the course, which is that "any system can not function effectively

if the set of essentially significant subsystems (elements of the system) is not functionally complete" [Led88]. This means that it must contain all the necessary components for the organization of educational activities (the necessary substantive content and tools for the implementation of certain types of educational activities aimed at achieving the planned educational results). In the case of the use of an e-course within the framework of the technology of blended learning, which includes, in addition to e-learning, traditional teaching aids, with the help of which some methodological tasks of the course can be solved, there is no need for the functional completeness of the electronic part of the course. However, if an e-course is applied as part of a distance learning technology, then the functional completeness of e-course components is an important condition for the effectiveness of the entire learning process and such an e-course should have a functionally complete set of didactic components for implementing all the main components of the learning process, as well as its planning and management them.

2. *The principle of modular construction* of the course. The specific structure of any e-course for distance learning is in its modular construction. Each module is a block (possibly autonomous) of a specific section of a school subject that solves a certain pedagogical task. The block should include clearly defined requirements for the level and time of mastering the educational material. The module can act as a test unit of discipline, the quality of work with which is fixed by coursework and examination and is checked by various test and measurement materials. A module consists of a set of frames, links to other modules and links between these frames and modules. A frame is a series of information objects (text, graphic, audio and video, animation elements, etc.) representing fragments of the content of an electronic course. When a frame is accessed, its visualized part is displayed on the screen in the structure of the electronic course itself or in a separate course window. A feature of the frame is that it is a complete didactic unit and should be displayed completely on the screen.
3. *The principle of hierarchy of didactic elements* of the electronic course. Each element of the electronic course should be considered as a system of interrelated components, including other subsystems. For example, each training module contains thematic units interconnected with each other, and within a separate topic specific issues are considered and certain training activities are formed, which can then be reproduced when studying another topic or another training module. Thus, a methodically sound choice of e-course elements (content and tools of learning activities) is able to provide an educational process that will lead to the achievement of planned educational results.
4. *The principle of synergy* is expressed in the fact that the projected electronic course cannot be reduced to a simple sum of its constituent elements. The e-course as a system phenomenon should create conditions for the integration of its constituent elements in order to improve the efficiency of the educational process. When developing an e-course, the economic aspect is important - the cost of such development and, since we consider the e-course as a single system, it should have unified interaction mechanisms that allow the introduction of new elements (by analogy with the principle of an open computer architecture). The use of standard functional mechanisms and IT models as part of an e-course can significantly reduce the cost of developing individual training modules, since an e-course is not created to solve the specific tasks of each individual module, but is designed with a focus on the content and functions of the entire e-learning course as a whole. This approach to the development of the course makes it possible to significantly reduce the cost of creating software products that are planned to be included in its composition [Bas10].

All the above principles naturally follow from the systemic nature of e-courses as a digital educational environment, providing the learning process with all the necessary tools for its implementation, including the subject content of education and the means of interaction between the subjects of the educational process.

In addition, the e-learning course should be focused on the following main *didactic functions*.

The e-course should support new types of educational activities, the implementation of which without the use of digital technologies would not be possible (for example, computer modeling, network interactive, etc.) [Zen15]. As part of the e-course should be components that provide the ability to change the nature of the interaction of subjects of the educational process. The role of the teacher should be transformed from a knowledge translator to a mentor and organizer of the cognitive process, the role of the learner from the object of pedagogical influence to the subject of the educational process, consciously making decisions, choosing the direction of further development, independently determining its educational trajectory based on self-reflection [Sob17].

The e-course should be aimed at the maximum individualization of the educational process (taking into account the principles of the system-activity approach to meet the individual educational needs of students of the course, their capabilities, initial level of preparation, rate of mental operations, preferential perceptual modality, etc.) [Kar17].

In order to meet the diverse educational needs of students, the e-course should have the ability to expand content in the most popular areas. This is possible through the use of hypertext technologies and hypermedia technology, by referring to a number of collections of electronic educational resources, resources of social networking communities of teachers, etc. [Suv18].

3.4 Methods of designing electronic advanced training courses for the development of ICT competence of teachers

The e-learning course is a high-tech product created on the basis of and using the most modern IT solutions. The development of courses is divided into two large blocks: the development of pedagogical design and the creation of media components [Cos04].

When designing an e-course for distance learning, first of all, it is necessary to pay special attention to the conceptual design stage, to think over and develop the structure of the course itself, to go through the work on the terms of reference, which are detailed step-by-step scenarios instructions for designers, computer methodologists and programmers of the company -customer (scenarios of the entire course, didactic units of the course on the specification, communication components, media components, etc.).

To determine a more detailed structure of the electronic course, the following trace elements are used in the module structure of this course:

1. Information about the author (s) of the course, with his photo, possible video / audio greeting. Brief creative biography of the author of the course, its main achievements.
2. Introduction (course information) - course annotation, target audience, formed competencies, curriculum, course goals and objectives, course organization, required educational literature, training procedure, place and relationship with other subjects (disciplines, courses).
3. The main text is in the form of a summary containing multimedia objects, hyperlinks to keywords (and, possibly, to multimedia objects), which are sent to other course pages and information sources. The text part of the module begins with the title, then - the body of the abstract with the main conclusions on the topic (section); the list of questions and test materials related to this topic (section) for input, current, intermediate, final control and self-control; the list of sources and additional materials for the study of this topic (section) of the electronic course.
4. Reference materials on the subject area of the course, a list of abbreviations and abbreviations (glossary). These materials should fully cover the content of the academic subject (discipline, course) and be hyperlinked to the main text (to have direct and reverse navigation).
5. Electronic library - a list of recommended main and additional literature with links to e-books on the subject of the subject (discipline, course), electronic library sites, addresses of Web-sites on the Internet. All links must be supplemented with annotations to digital educational resources.
6. Means of cooperation of the student with the teacher and other students (network services: e-mail, blogs, forums, chat rooms, etc.) involving communication, teamwork of students, express questions and answers to them, various forms of interaction with the teacher (tutor).
7. Practical and laboratory work aimed at improving the quality of learning theoretical material of the course. Preliminary, it is recommended to carry out access to this type of occupation, to check the knowledge of theoretical material. This block may include creative tasks (term papers, essays, problem situations (texts of the task to identify the depth of understanding of the material), etc., focused on working out the studied information and new types of learning activities. Laboratory works can be presented as a virtual laboratory workshop - an interactive software module designed to implement the transition from the information-illustrative function of digital sources to the function-instrumental, search function; contributes to the development critical thinking, the development of skills and abilities of the practical use of the information received [Lys15].
8. Database of essays, projects, business cards and other creative work of students, presentations, Web-portfolio of students.
9. Package of questionnaires. The e-course package includes questionnaires for acquaintance with potential students and a test package for determining their initial level of knowledge in the subject (discipline, course).
10. Block of monitoring and reflection of the results of educational work, aimed at developing the skills and abilities of self-regulation based on the analysis of the most common errors.

The listed microelements of the e-course modules can vary among themselves, dominate one another, and be supplemented with other microelements not included in the list.

Designing an e-course is a process characterized by the presence of a structure (a sequence of stages and stages), a set of procedures and means of technical implementation, interaction between the participants of this process.

In the process of designing an electronic course, the following basic steps can be distinguished, which are regulated by GOST [GOST]:

- technical task,
- preliminary design,
- technical project,
- working draft
- implementation of development results.

At the stage of creating technical specifications, the developers cooperate with customers (teachers and methodologists). This stage is preceded by a preparatory stage - the so-called "external design the implementation of preliminary work by the customer, based on the conceptual design of the entire e-course, during which the goals and objectives of training activities are defined, a training model is created (mechanisms and principles of training, components of training activities, levels of cognitive activity of students, types of educational interaction (interaction).

At this stage, describes:

- the level of education, which is focused on developing an e-course,
- application model
- the main methodological functions that the e-course is aimed at,
- requirements for the level of user ICT competence of students and teachers,
- course program,
- hierarchical structure of the subject material with an indication of metasubject components, description of the continuity of the electronic course,
- ways and forms of presentation of educational material
- types of interactivity,
- models of objects and processes under study
- contact time evaluation and so on.

At the preparatory stage of designing an electronic course, the authors need to solve the following sequence of tasks:

- identify means of initiating specific activities;
- determine which digital resources have been developed to initiate activities and find them;
- to determine for the initiation of which activities of digital resources are not yet available and their development is necessary;
- take into account the constraints imposed by the material and technical conditions of the educational process;
- to focus digital resources designed within the framework of the e-course to solve the most important didactic tasks, making the most complete use of their specific didactic capabilities and properties;
- when developing an e-course, take into account the system of didactic, methodical, technical-technological, ergonomic, hygienic requirements and requirements of a system-activity approach to the tools of educational activity.

It can be said that at this stage there is the so-called pedagogical design, which consists in the preliminary development of the stages of the activity of students and the teacher in the course of their interaction with the developed electronic course.

Modern Standards [Stand13; Stand17] consider the design activity of a teacher as one of the key ones. The reasons for such close attention to this type of activity of a teacher are found in the methodological foundations of the Standards, directly related to the theories of the system-activity approach to learning. In accordance with the principles of these theories, the teacher designs the learning process, starting with an analysis of the planned learning outcomes, goals, objectives, moving to building meaningful lines for studying the subject, developing a pedagogical scenario, designing new types of students' activities, planning and selecting the corresponding learning situations, innovative methods and organizational forms of training, building a system of requirements for electronic learning tools that are necessary for the implementation of the proposed training activities of students.

In addition to all the above, it is necessary to develop conceptual aspects of the implementation of the e-course, reflecting the authors' positions on the principles of structuring educational information, control methods and the development of criteria for evaluating the generated knowledge and methods of action, on tools to

ensure interactivity, on materials containing methodological recommendations didactic techniques that are able to provide new qualities of electronic educational resources in comparison with traditional means of teaching. To fulfill these conditions, fluency in modern digital didactics is necessary.

In order for digital technologies to be able to manifest their specific properties and, substantially, purposefully transform the learning activities they support, they need to be developed as part of a student-centered learning model with a focus on developing the skills of research and project activities in students.

The terms of reference is the original document of the design process of any object that has legal force. The quality and effectiveness of the developed e-course directly depends on the quality of its development, on the validity of the requirements contained in it. The development stage of a technical building can be compared with the demarcation line dividing the area of responsibility of customers and performers, since the executor performs all subsequent stages (except for the acceptance stage) without the participation of the customer. Creating a technical assignment plays a crucial role, since it is one of the first stages of developing an e-course and is characterized by a high cost of error: the earlier the errors are made and the later they are discovered, the more expensive their correction becomes. The quality of work at this stage highly determines the success or non-success of the e-course as a whole.

Rules for the development and execution of technical specifications are set in a number of regulatory documents, including: GOST 19.201–78, GOST 34.602–89, GOST 25123–82, GOST 2.114–95. In accordance with GOST 19.101–77, the terms of reference is a collection of data on the purpose and scope of the e-course, technical, feasibility and special requirements for the program, the main stages of development and the types of tests. The terms of reference is the source document in the design of an e-course. It states what the customer needs, in contrast to all subsequent types of project documentation, which state how to achieve this? The terms of reference is a legal document attached to the contract between the customer and the contractor and its basis, as it contains the order and conditions of work, goals, objectives, principles, expected results and deadlines for the work. All amendments, changes or additions to the technical task must be agreed with the customer and approved by him.

Apparently, the problems of developing a technical assignment are associated with the fact that knowledge in the field of pedagogy is difficult to formalize. The term “pedagogical technologies” may be introduced into a misconception about the possibility of formalizing and technologizing the learning process. Actually, after careful consideration of the essence of these “pedagogical technologies” , it becomes obvious that they cannot be called technologies in the strict sense of the word, since their presentation does not meet the requirement of a full description of all technological operations in the sequence of their execution, indicating transitions and technological regimes.

4 Conclusion

Summarizing all the above, we can draw the following general conclusions. The methodology for designing electronic refresher courses on the development of information competence of teachers is focused on the goals of such training, which are reflected in the documents of international organizations and in state standards. The development of an e-course should be carried out in accordance with the rules and requirements for any software product, enshrined in the relevant state standards. The main difficulties in the design of electronic courses arise at the stage of drawing up a detailed technical task, therefore, in order to prepare for this stage, it is necessary to carry out external “pedagogical” design in order to describe the key parameters of the technical task as detailed as possible. The stages of external design and the wording of the technical specifications are extremely important, because an incorrectly formulated task cannot lead to the correct solution. Insufficient elaboration in solving issues of implementation of these stages leads to the fact that low-quality e-courses are being created. All this happens due to the lack of understanding between customers (teachers and methodologists) and performers (programmers), because programmers do not receive from customers sufficient psychological, pedagogical and didactic requirements for the developed electronic course, on the basis of which it would be possible to work together to develop a detailed technical task . Thus, to develop a full-fledged, high-quality and popular electronic course is possible only when all the conditions specified in the article are fulfilled.

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