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IN COMPUTING EDUCATION



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Use Case for Creative Learning-by-Authoring

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Abstract: *The paper presents an extension of the use case scenario dealing with the formal presentation technology-enhanced learning process in the frames of the SINUS project "Semantic Technologies for Web Services and Technology Enhanced Learning". The main goal is to demonstrate creative learning-by-doing through active learners' authoring of specific learning materials, using multimedia and information resources delivered through the "Virtual Encyclopaedia of the East-Christian Art" digital library. The presented use case also involves collaborative work and discussion approaches in order to attract learners into more active participation in the learning process.*

Key words: *Use Case Scenario, Technology-Enhanced Learning, Learning-by-Authoring, East Christian Iconographical Art.*

INTRODUCTION

The new strategies for technology-enhanced learning point to the investigation and the deployment of workable learning methods and scenarios for creative thinking, learning-by-doing and learning-by-authoring, engaging learners in more active participation during the perceiving of knowledge. Creativity is described as "a fundamental dimension of human activity" in [1]. The main questions asked are: How could learners' creativity be activated and stimulated? What tasks could be interesting and attractive and could stimulate learners' desire to work? What learning methods can be used in order to attract learners in more active participation in the learning process? *etc.*

The proper solutions of these problems are essential in education in Fine Art, and particularly education in East Christian iconographical art. Moreover, arts learners have to work every moment on their professional development in the direction of creativity.

Having in mind the learners' needs and their features in the Project SINUS we started a long-term consideration of use cases in a scenario for technology-enhanced learning on East Christian iconographical art and culture. Our aim is to demonstrate creative learning-by-doing through active learners' authoring of specific learning materials, using multimedia and information resources delivered through the "Virtual Encyclopaedia of the East-Christian Art" digital library [7, 9]. The specific learning resources are united in a *project* with the main creators – the learners themselves – aided by their mentor/advisor. The *project* includes several analyses of different thematically related problems (for example, theological meaning of the Iconography of Christ, art critical analysis of the development of Christ's image in the different iconographical schools in Bulgaria, study of the main iconographic techniques used in the historical territories of Bulgaria for the Christ's depiction, *etc.*), discussed and refined during the discussion of the analysis between the project participants. Similar approaches with implementation of methods of creative discussion on learners' thematic presentation for collaborative learning are described in [4, 12].

This paper presents a use case (a real learning situation), expanding the SINUS technology-enhanced learning scenario described in [11] with creative learning-by-authoring united with collaborative work and discussion approaches.

The paper also includes the stages of the SINUS scenario development, its objectives, methodology, used and created resources, and the users' background. Finally, the paper discusses the future work on the implementation of the described use case.

STAGES OF THE USE CASE SCENARIO DEVELOPMENT

"The learning scenarios in system design describe typical or important ways of use

of the system. They are designed to give all the partners in the project (both technical partners and content providers) a shared understanding on the purpose of the system and the ways it will be of use in practice" [3].

The present scenario follows the base methodology of use cases development presented in [2]. It went through the following stages [5]:

Stage 1: Determining the needed functionality of the use case scenario and all ontological and g noseological assumptions, the methodological approach, basic requirements, detailisation phases of development, *etc.*

Stage 2: Description of a real learning situation of creative learning-by-doing through active learners' authoring of specific learning materials, using multimedia and information resources (media objects, descriptions, glossaries), delivered by the chosen knowledge repository, *viz.*, "Virtual Encyclopaedia of the East-Christian Art" digital library; Learning methods, situations and context of use. Special attention is paid to the learning content in the areas of cultural heritage and in particular in the area of East Christian iconographical culture and art and the learner's features and needs [6, 7, 11].

Stage 3: Presentation of the general formulation of the scenario with a clear definition of the objectives, basic type of resources, user groups, activities, requirements, preferences, motivation, needed and/or required information services along the learning process according to the various users, other required functionalities and i nformation processes to be achieved [11].

Stage 4: Formalization of the scenario and presentation of the functionality required by the users via a combination of activities that can be carried out by the SINUS platform. For each activity the following information is defined: input and output data, user group performing the activity, steps leading to the accomplishment of the activity, information structures and tools needed for the development, and maintenance of resources supporting the activity.

Stage 5: Development of the scenario and definition of a minimal and extended variant.

Stage 6: Determining the basic requirements to the multimedia, semantic and learning resources supporting the use case scenario.

USE CASE SCENARIO CHARACTERISTICS

Overall objective

The overall objective of this scenario is to describe the basic ways of exploitation (called activities) of the SINUS platform for technology-enhanced learning by various types of users in order to provide services for creative learning-by-doing through active learners' authoring of specific learning materials, using multimedia and information resources delivered by the chosen knowledge repository. For each activity the following components are defined: input and output data, users, the steps needed to accomplish the activity, the activity's information structures and tools [11].

Methodology

The main learning goal of the use case scenario is the project development. Examples of learning sub-goals in the scenario are: the learner has to analyse a character, the learner has to find iconographic objects, the learner has to track iconographic technique, the learner has to develop iconographical object, the learner has to compare iconographic objects according to used iconographic technique, *etc.* In order to achieve the main goal the following theoretical and experimental methods are used: comparison and differentiation, analysis, and interactive methods including group work, discussion and debate.

Basic resources

The basic types of resources managed or provided by the SINUS platform are: primary annotated digital resources, semantically annotated digital resources, learning resource, semantic resources (ontologies), and profiles of users. Their essences are described in detail in [11].

Users

According to the scenario, the main user groups of the SINUS platform are the developers of various resources (*i.e.* authors of semantic resources, authors of semantic digital resources (annotators), authors of learning resources) and the consumers of those learning resources (*i.e.* academic users, researchers in the target learning domain, non-academic users). Their needs and motivations are described in detail in [11]. Academic users and researchers as the major learners can also be authors of learning resources. These users should normally possess a medium or high level of knowledge in the target learning domain or should plan to use the SINUS platform to reach a high level in this domain. They actively search and use the digital resources found to accomplish their learning goals (examples, development of thematic projects, term projects, graduation works, preparation of analysis and analytic searches of various problems in the area, performing formal TEL education, *etc.*).

A REAL SITUATION (USE CASE) DEMONSTRATING THE SINUS SCENARIO

Title of the learning situation: Development of the project *The Iconography of Christ in the Historical territories of Bulgaria*.

Learning domain: East-Christian culture and art.

Primary source of digital objects for the learning domain: "Virtual Encyclopaedia of the East-Christian art" multimedia digital library.

Users: developers of learning resources and users of the learning resources.

General scenario situation: Professor Ivanov is a lecturer at the National Art School. He is delivering a course on Iconography for students of different classes of the Wall Painting and Art History departments and students of the Faculty of Theology of Sofia University. To all his students he has given the task to prepare a project on the Iconography of Christ in the historical territories of Bulgaria. This project supposes a division of the students into several teams according to their interests: Theology team, Art Critics team, Art Technique team, and Artistic team. Prof. Ivanov assigns to the different workgroups the following particular tasks:

1. to make an analysis of the theological meaning of the iconography of Christ (the Theology team);
2. to make an art critical analysis of the chronological development of the iconography of Christ in the different iconographical schools in Bulgaria (the Art Critics team);
3. to examine the main iconographic techniques used in the best Bulgarian examples of iconography of Christ (the Art Technique team);
4. to make an icon of Christ or a part of a mural painting depicting one of the Christ's feasts (the Artistic team).

To prepare their analyses, the participants in the teams perform various specific tasks assigned by Professor Ivanov, for example:

Sample task for the Arts Critics team: Make an art critical analysis of the development in time of the iconographic image of Jesus Christ in the various iconographical schools on Bulgarian land.

Steps to perform in the SINUS learning environment:

1. Select a minimum of 6 iconographic object containing the image of Jesus Christ in a one-figure composition (Note: The right choice requires selecting iconographic objects with the character or Jesus Christ Pantocrator, or Blessing Christ, or Jesus Christ enthroned, or St. Veronica, etc.).
2. Arrange the iconographic objects in groups by school of iconography.
3. If a school of iconography's group contains objects by an eminent author and founder of the school, place these high on the list. Among the objects designated for art critical analysis there should be at least one by a prominent author/school founder, if available.
4. Ensure that the iconographic objects designated for art critical analysis are currently in good condition.
5. Ensure that at least one primitive iconographic object and at least one Renaissance iconographic object are included in the iconographic objects designated for art critical analysis.

In writing the art critical analysis compare the selected iconographic objects by contrasting clothing, gesture/s, the character proportions, object/s, the presence of other character/s and/or symbol/s, backgrounds, other element/s (e.g., clouds, etc.) in the iconography of the image of Christ. Look for changes in the iconography of these components, for example, appearance or lack of components (objects, symbols, characters, etc.), changes in the background, clothing, etc., in the selected set of samples.

Sample task for the Art Technique team: Find iconographic artifacts/objects containing the image of Jesus Christ in order to compare their specifics from a technological point of view.

Steps to perform in the SINUS learning environment:

1. Find all the iconographic scenes with Jesus Christ.
2. Choose one iconographic scene with a Lord's Day (Holy Cross, Nativity, Epiphany, Palm Sunday, Ascension, Pentecost and Transfiguration), with the most samples (iconographic objects), minimum 6.
3. Ensure the selected iconographic objects are on solid base (wood, stone and metal, bone, glass).
4. Ensure only iconographic techniques (tempera, oil, mixed) are used in the painting of the iconographic objects.
5. Ensure the iconographic objects contain gilding.
6. Ensure the Iconographic objects are arranged by temporal characteristics, for example, century.

In writing the analysis compare iconographic objects in one or more iconographic techniques and evaluate the quality of their execution. Look for periodisations of the employed iconographic techniques in the selected set of samples. Examine the type and technology of the gilding and the structure of the base.

In a similar way the Theology team perform the specific tasks assigned to them.

Every team prepares a multimedia demonstration (multimedia presentation, film) for a collaborative discussion forum on the basis of the text version of the analysis. At a special working meeting a representative of each team demonstrates the theses and results of the analysis to the other teams through the multimedia demonstration. The listeners from the other teams and Prof. Ivanov, who have previously become familiar with the text version, actively follow the demonstration and formulate questions, comments, ideas to discuss. On the basis of the discussions and presentations a specific task for the artistic team to draw an iconographic object is collectively chosen. After the working meeting each team prepares a final version of its analysis, consistent with the discussed issues. The Artistic team performs the task of drawing an iconographic object, using the learning materials

produced by their colleagues from the Art Critics, Theology and Technique of Iconography teams.

Professor Ivanov evaluates each team according to:

- Completeness, adequacy and correctness of the text material (choice of collection, choice of base characteristic/s of the iconographic objects to use when implementing the analysis, adequacy of the findings and conclusion of the analysis);
- Attractiveness of the multimedia presentation of the theses and results of the analysis;
- Questions/comments, their meaning and correctness, creative ideas and thinking.

CONCLUSIONS AND FUTURE WORK

This paper demonstrates a different method for technology-enhanced learning, joining analysis, collaborative work, discussion, learning-by-authoring, and learning-by-doing approaches in order to achieve more active participation of the learners during the perceiving of knowledge and to stimulate their creative thinking. Nowadays, the work continues on the refinement of the implementation of the use case and the development of necessary functionality of the SINUS learning platform. In fact the scenario implicitly poses the specific requirements for the different components of the SINUS platform, supporting considerably the design of such a service-oriented architecture, as well as determining the functional specifications of the services provided by the platform, the needed information services, methods and operations on the different levels of exploitation, the users and their activities, etc. On the basis of the use case scenario one could plan the testing and the evaluation of the platform and its components, as well as the functionality and the multiple reusability of the selected project approach.

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