CONTRIBUTIONS OF THE THESIS

Major scientific and applied contributions of the thesis are:

- Developed a framework and models for supporting effective personalized learning services on top of multimedia digital libraries, by a) supporting re-purposing of multimedia digital content/archives to cultural digital objects, learning objects and higher learning units, b) supporting the construction of pedagogy-driven personalized learning experiences on top of multimedia digital archives statically or dynamically. The following models have been defined:

    - Domain model: a) Defined the object layers from content assets, to cultural digital objects, to learning/assessment objects and learning components, and their description, structuring and relation exploiting METS, LOM and other standards to support pedagogy-driven personalization; b) Specified the authoring/repurposing process and pedagogical aspects and requirements for the proper description of learning objects to support pedagogy-driven personalization (e.g. different learning styles) without being tied to a specific learning style taxonomy.

    - Learner model: Identified important learner characteristics and preferences that should be taken into account in personalization process and encoded them in an ontology.

    - Instructional model for the encoding of instructional strategies as abstract training scenarios (educational templates) taking into account related standards as IMD LD. These templates are reusable and separated from content, allowing appropriate learning resources according to the Learner profile and current context to be bound to the training scenario at run-time.

    - Adaptation model: The adaptation process is encapsulated in an appropriate personalization algorithm that exploits information from the Learner model to firstly select appropriate abstract training scenarios matching Learner's needs and preferences and proceeds with the binding of appropriate reusable Learning Objects to the learning activities of the selected scenario. The same mechanism can be used to construct assessment tests from assessment objects that can be used for the identification of the previous knowledge of the Learner.

- Developed an integrated service-oriented architecture and functional components (including repositories, tools, delivery components, applications and services) based on interoperability-

standards to support repurposing of existing multimedia digital content to cultural digital objects, learning objects and higher learning units and construction of pedagogy-driven personalized learning experiences statically or dynamically. The architecture supports interoperability and sharing of cultural digital objects, learning objects and learning experiences with existing eLearning systems and large repositories/aggregators.

- Implementation of the proposed framework and architecture in LOGOS project and application of the proposed methodology and solutions in the implementation of Natural Europe project to support the need of Natural History Museums to make available their cultural digital collections and support their gradual repurposing to develop (statically) pedagogy-driven learning experiences with the use of educational pathways based on educational templates.

Results from the research done in a number of **European Research & Development projects** (listed below) were combined, enriched, specialized and applied in the PhD thesis for the domain of cultural digital libraries:

- The framework presented in this thesis has been exploited in Research project No. DN02/06/15.12.2016 "Concepts and Models for Innovation Ecosystems of Digital Cultural Assets" (2016 - 2018), funded by the Bulgarian Sciences Fund, and in specific in WP2: "Creating models and tools for improved use, research and delivery of digital cultural resources". The project will conduct fundamental research in the areas of computer science, information and communication technology and partially in the humanities and social sciences with the goal of acquiring new knowledge on the fundamental causes of phenomena and observable facts in these areas without any direct commercial application or use.

- The work presented in this thesis was implemented in IST/STREP **LOGOS project** "Knowledge-on-Demand for Ubiquitous Learning" (IST-4-027451) (**common project of TUC/MUSIC with IMI-BAS**), where a Knowledge-on-Demand ubiquitous learning platform was developed, providing effective personalized learning services to support learning anywhere, anytime exploiting alternative delivery channels and related devices that go beyond the traditional web-based learning approaches. The framework and architecture proposed were applied and implemented to support the needs of repurposing of existing multimedia material and the gradual development of pedagogy-driven personalized learning experiences in a static or dynamic way. Publications in the context of LOGOS project: [Arapi, Moumoutzis, Mylonakis, Theodorakis, and Stylianakis, 2007; Arapi, Moumoutzis, Mylonakis, Stylianakis, Theodorakis, and Christodoulakis, 2008]

- Methodology and solutions proposed in this thesis were applied in the implemention of the ICT/PSP **Natural Europe project** "Natural History & Environmental Cultural Heritage in European Digital Libraries for Education" (FP7-ICT-PSP: 250579) to support the need of Natural History Museums to make available their cultural digital collections and support their gradual repurposing to develop pedagogy-driven learning experiences with the use of educational pathways based on educational templates. The author of this thesis was not only a senior researcher in the realization of the project, but also one of the main authors of Natural Europe proposal where she proposed to apply this framework methodology and solutions successfully implemented in LOGOS to support these objectives. Publications in the context of Natural Europe project: [Mylonakis, Arapi, Moumoutzis, Christodoulakis, and Ampartzaki, 2013; Makris, Skevakis, Kalokyri, Arapi, Christodoulakis, Stoitsis, Manolis, and Leon Rojas, 2013; Makris, Skevakis, Kalokyri, Arapi, and Christodoulakis, 2013]

- Parts of the methodology and tools presented in this thesis were applied to LdV/ToI **QONIAon project** "VET Qualification Practice for e-Inclusion" (2013-1-TRI-LEO05-47585) (**common project of TUC/MUSIC with IMI-BAS**) promoting the idea for e-facilitator as instrument for e-Inclusion with it's curriculum, methodology, technology, experience, appropriate LMS, content and use case scenarios. The proposed solutions were applied to support the development of its curriculum, its description, provision and further dissemination. Publications in the context of QONIAon project: [Mylonakis, Arapi, Moumoutzis, Christodoulakis, and Ampartzaki, 2013; Mylonakis, Arapi, Pappas, Moumoutzis, and Christodoulakis, 2011]

- Finally, results of this thesis related with instructional design have been applied in ICT/PSP **Open Discovery Space project** "A socially-powered and multilingual open learning infrastructure to boost the adoption of eLearning resources" (FP7-ICT-PSP: 297229). Publications in the context of ODS project: [Stylianakis, Moumoutzis, Arapi, and Christodoulakis, 2013; Stylianakis, Moumoutzis, Arapi, Mylonakis, and Christodoulakis, 2014].

Furthermore, parts of the work done in the scope of this thesis have been published in a number of **peer reviewed journals and conference proceedings** (see "LIST OF THE AUTHOR'S PUBLICATIONS RELATED WITH PHD THESIS"): International Journal on Digital Libraries - IJDL (Springer, 2014) and International Journal of Education and Information Technologies (NAUN, 2016), 6th International Conference on Web-based Learning - ICWL 2007 (Edinburgh, UK, 2007), IEEE International Conference on Advanced Learning Technologies - ICALT 2007 (Niigata, Japan, 2007), Workshop on Cross-Media and Personalized Learning Applications on top of Digital Libraries (LADL2007) in conj. with ECDL2007 Conference (Budapest, Hungary, 2007), 2nd LOGOS Open Workshop on "Cross-Media and Personalized Learning Applications with Intelligent

Content" (LAIC 2008) in conj. with AIMSA2008 Conference (Varna, Bulgaria, 2008), Metadata Semantics and Research Conference - MTSR2011 (Izmir, Turkey, 2011) and MTSR2013 (Thessaloniki, Greece, 2013), 2nd International Conference on E-Learning, and E-Technologies in Education - ICEEE 2013 (Lodz, Poland, 2013), 17th International Conference on Theory and Practice of Digital Libraries - TPDL2013 (Valetta, Malta, 2013), IEEE Interactive Mobile Communication Technologies and Learning - IMCL2014 (Thessaloniki, Greece, 2014), and International Conference on e-Learning - eLearning'16 (Bratislava, Slovakia, 2016). About 40 citations have been detected.

The results obtained in the development and realization of this thesis shows that the study can be extended and developed in the following areas:

- Theoretical direction: 1) Extension/adaptation of the developed models towards supporting re-purposing and transformation of a digital library content and provision of personalized experiences in other domains and applications (at the same time), such as eScience, eResearch etc. This extension is possible since the proposed framework is generic enough to support multiple-context views of the content of a digital library and its transformation targeting at different applications. 2) Extension and exploitation of the framework to support the construction of Personal Learning Environments (PLEs), combining tools, services and resources, which learners use to direct their own learning and pursue educational goals.

- Applied/practical direction: Implementation and experimentation with other applications (eScience, eResearch etc.) on top of digital libraries, i.e. to offer services and tools supporting re-purposing of the underlying content, and provision of effective personalized experiences by real-time integration of content, tools and services to fit the needs of different target groups.