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Visual-Project Competence in 2D/3D Graphic Design as a Pedagogical Basis for Training Restorers, Reconstructors and Revitalisation Specialists in Cultural Heritage

Abstract:

This article is devoted to the theoretical substantiation of visual-project competence in 2D/3D graphic design as a pedagogical basis for training restorers, reconstructors and revitalisation specialists in the field of cultural heritage. The relevance of the study is determined by the growing role of graphic design in contemporary heritage practice, where 2D and 3D visual tools are used not only for presentation, but also for documentation, analysis, reconstruction, modelling, interpretation and public communication. The scientific novelty of the study lies in interpreting 2D/3D graphic design not as an auxiliary technical or illustrative skill, but as a core pedagogical mechanism for forming visual-project competence. The object of the study is the educational process in the professional training of restorers, reconstructors and revitalisation specialists in cultural heritage. The subject of the study is the pedagogical mechanisms for forming visual-project competence in 2D and 3D graphic design. The study aims to develop and theoretically substantiate a pedagogical model for integrating 2D and 3D graphic design into cultural heritage education. The study has a theoretical and analytical research design. Its methodological basis includes theoretical analysis, conceptual reconstruction, comparative interpretation, systematisation and pedagogical modelling. The source base consists of scholarly and methodological works on cultural heritage education, graphic design pedagogy, visual communication, design thinking, 3D documentation, digital reconstruction, HBIM, virtual archaeology, digital heritage and revitalisation practices. The article establishes that 2D graphic design forms the analytical language of restoration documentation. It enables students to record, classify and interpret the condition of heritage objects through damage maps, analytical diagrams, restoration charts, typological schemes and project boards. The study also shows that 3D graphic design forms a higher level of visual-project competence by developing spatial modelling, digital documentation, reconstruction hypotheses, simulation of lost elements and visualisation of revitalisation scenarios. The author substantiates visual-project competence as an integrated pedagogical construct that includes analytical, artistic-compositional, technical-digital, reconstructive, communicative and project-based components. On this basis, a pedagogical model is proposed that integrates 2D and 3D graphic design through three functional levels: analytical-documentary, reconstructive-digital and communicative-revitalisation. The author concludes that the systematic inclusion of 2D/3D graphic design in cultural heritage education makes it possible to overcome the fragmentation of specialist training and to prepare professionals capable of analysing, modelling, reconstructing and revitalising cultural heritage as a complex visual, spatial, historical, technological and social system.

Keywords: solfège, pop singing, professional training of vocalists, vocal performance education, integrative approach, competency-based approach, interdisciplinary integration, musical-auditory competencies, professional competence of the singer.

Introduction

In the context of contemporary transformations in art education, digital technologies and cultural heritage preservation, the role of graphic design is undergoing a significant conceptual expansion. Graphic design is no longer limited to the creation of visual communication products, printed materials, branding systems or digital interfaces. In the field of cultural heritage, 2D and 3D graphic design increasingly functions as an analytical, reconstructive, project-based and communicative tool. It allows specialists to document the condition of heritage objects, visualise losses and structural changes, model hypothetical reconstructions, present restoration solutions, design revitalisation concepts and communicate heritage values to professional and public audiences.

The relevance of the present study is determined by the growing need to modernise the professional training of restorers, reconstructors and revitalisation specialists. Contemporary work with cultural heritage requires not only historical knowledge, artistic sensitivity and technological competence, but also the ability to operate with complex visual systems. A specialist in this field must be able to read, interpret, produce and critically evaluate 2D and 3D visual materials: drawings, diagrams, damage maps, restoration schemes, reconstruction models, visual scenarios, digital twins, exhibition graphics, navigation systems and project presentations. Therefore, visual-project competence becomes one of the key components of contemporary cultural heritage education.

The problem of the study is associated with the insufficient theoretical and pedagogical development of 2D/3D graphic design as an integrated component of specialist training in the field of cultural heritage. In many educational models, graphic design is still perceived either as a technical means of visualisation or as an auxiliary artistic discipline. Such an approach does not fully reflect the current professional reality, in which graphic design participates in the entire cycle of heritage work: from analysis and documentation to reconstruction, interpretation, revitalisation and public communication. As a result, future specialists may acquire separate historical, restoration or digital skills, but lack an integrated visual-project competence necessary for complex professional decision-making.

The scientific novelty of the study lies in interpreting 2D/3D graphic design not merely as a technical or illustrative skill, but as a core pedagogical mechanism for forming visual-project competence in the training of cultural heritage specialists. The article proposes to consider graphic design as a systemic educational tool that integrates artistic, analytical, technological, reconstructive and communicative functions. Within this approach, 2D and 3D design are understood as complementary visual languages: 2D design provides analytical clarity, graphic structuring and documentation, while 3D design enables spatial modelling, reconstruction, simulation and digital representation of heritage objects.

The object of the study is the educational process in the professional training of restorers, reconstructors and revitalisation specialists in the field of cultural heritage.

The subject of the study is the pedagogical mechanisms for forming visual-project competence in 2D and 3D graphic design as part of professional cultural heritage education.

The aim of the study is to develop and theoretically substantiate a pedagogical model for integrating 2D and 3D graphic design into the training of restorers, reconstructors and revitalisation specialists in cultural heritage.

To achieve this aim, the following research objectives have been defined:

- to analyse the role of 2D and 3D graphic design in contemporary professional activity related to cultural heritage preservation, reconstruction and revitalisation;
- to clarify the concept of visual-project competence in the context of cultural heritage education;
- to identify the main pedagogical functions of 2D/3D graphic design in the training of restorers, reconstructors and revitalisation specialists;
- to determine the structural components of visual-project competence required for work with cultural heritage objects;
- to develop a theoretical pedagogical model for integrating 2D and 3D graphic design into cultural heritage curricula;
- to substantiate the educational significance of digital visualisation, 3D modelling and project communication in the formation of contemporary heritage specialists.

The theoretical significance of the study lies in the development of a pedagogical interpretation of graphic design as a professional and methodological component of cultural heritage education. The article expands the conceptual apparatus of heritage pedagogy by introducing visual-project competence as an integrated educational category. This makes it possible to analyse the training of restorers, reconstructors and revitalisation specialists not only through the prism of historical, technical or conservation-related knowledge, but also through the formation of visual thinking, spatial modelling, graphic analysis and project-based communication.

The practical significance of the study consists in the possibility of applying the proposed model in the design of educational programmes, university courses, professional training modules and interdisciplinary curricula in cultural heritage. The results may be used in programmes related to restoration education, heritage reconstruction, museum design, digital heritage, architectural heritage, exhibition design, urban revitalisation and cultural project management. The proposed approach may also support the development of practical assignments, project-based learning tasks, digital portfolios, 2D/3D visual documentation systems and assessment criteria for visual-project competence.

Thus, the present study addresses the need for a more systematic integration of 2D and 3D graphic design into cultural heritage education. By interpreting graphic design as a pedagogical basis for visual-project competence, the article seeks to demonstrate that contemporary restorers, reconstructors and revitalisation specialists must be trained not only to preserve heritage objects, but also to analyse, model, interpret and communicate them through advanced visual and digital means.

Methods

The present study has a theoretical and analytical research design and is aimed at developing a pedagogical model for integrating 2D and 3D graphic design into the professional training of restorers, reconstructors and revitalisation specialists in the field of cultural heritage. In accordance

with the nature of the research problem, the study does not include empirical measurement, experimental procedures or quantitative data collection. Instead, it is based on theoretical analysis, conceptual reconstruction, comparative interpretation and pedagogical modelling.

The methodological logic of the study is determined by the interdisciplinary nature of the topic. The formation of visual-project competence in cultural heritage education requires the integration of several fields: pedagogy, graphic design, digital art, restoration theory, heritage reconstruction, architectural visualisation, museum communication, digital heritage and revitalisation studies. Therefore, 2D and 3D graphic design are analysed not as isolated artistic or technical disciplines, but as components of a broader educational system aimed at preparing specialists capable of analysing, modelling, interpreting and communicating cultural heritage objects.

The research material consists of scholarly works and methodological sources devoted to cultural heritage education, restoration training, graphic design pedagogy, visual communication, 3D modelling, digital reconstruction, heritage visualisation, digital twins, museum interpretation and revitalisation practices. Particular attention is paid to sources that make it possible to interpret graphic design as an analytical, reconstructive and communicative instrument in the professional activity of cultural heritage specialists.

The criteria for selecting sources were as follows: relevance to cultural heritage education; connection with 2D and 3D visualisation practices; significance for restoration, reconstruction and revitalisation training; applicability to the development of visual-project competence; and representativeness for contemporary interdisciplinary research in art education, digital heritage and professional design pedagogy. Sources were selected in order to provide a conceptual basis for analysing graphic design not only as a means of presentation, but also as a method of professional thinking and project-based work with cultural heritage.

The analytical procedure included several consecutive stages. At the first stage, contemporary approaches to cultural heritage education and the professional training of restorers, reconstructors and revitalisation specialists were analysed. At the second stage, the functions of 2D and 3D graphic design in restoration documentation, reconstruction modelling and heritage revitalisation were identified. At the third stage, the concept of visual-project competence was reconstructed as an integrated pedagogical category. At the fourth stage, the structural components of this competence were classified. At the fifth stage, pedagogical conditions for its formation were determined. At the final stage, the obtained results were integrated into a theoretical pedagogical model.

The methodology of the study includes general scientific methods and specialised pedagogical methods. General scientific methods include analysis, synthesis, comparison, generalisation and classification. These methods were used to identify the main conceptual categories of the study, compare different theoretical approaches and systematise the functions of 2D/3D graphic design in cultural heritage education. Specialised methods include conceptual reconstruction, interpretative analysis and pedagogical modelling. Conceptual reconstruction was used to clarify the meaning of visual-project competence. Interpretative analysis made it possible to reveal the educational significance of graphic design in the training of heritage specialists. Pedagogical modelling was applied to develop a structured model for integrating 2D and 3D graphic design into cultural heritage curricula.

Within the framework of the study, visual-project competence is understood as an integrated professional ability that combines visual thinking, graphic analysis, spatial modelling, design interpretation, digital visualisation and project communication. This competence includes the ability to document the condition of heritage objects, represent material losses and structural transformations, model reconstruction hypotheses, visualise revitalisation scenarios and communicate project decisions to professional and public audiences.

The study proceeds from the assumption that 2D and 3D graphic design perform different but complementary pedagogical functions. 2D graphic design supports analytical clarity, visual classification, restoration documentation, schematic representation and professional communication. It is especially important for damage maps, restoration charts, object passports, typological schemes, infographics, exhibition graphics and project presentations. 3D graphic design supports spatial analysis, hypothetical reconstruction, digital modelling, simulation of lost elements, visualisation of revitalisation scenarios and the creation of digital heritage environments. Together, these forms of design create a visual-project language necessary for contemporary heritage practice.

The proposed pedagogical model was developed through the identification of several interrelated components of visual-project competence: analytical, artistic-compositional, technical-digital, reconstructive, communicative and project-based components. The analytical component reflects the ability to interpret the condition, structure and transformation of a heritage object through visual means. The artistic-compositional component concerns the ability to organise visual material according to principles of graphic clarity, hierarchy and aesthetic coherence. The technical-digital component includes skills in working with digital design tools, 3D modelling software, visualisation systems and digital documentation. The reconstructive component reflects the ability to model lost, damaged or hypothetical elements of cultural heritage. The communicative component is connected with the presentation of restoration, reconstruction and revitalisation concepts to specialists, institutions and the public. The project-based component ensures the integration of visual decisions into broader heritage preservation and revitalisation strategies.

The validity of the study is ensured by the logical consistency between the research aim, methodological procedure and proposed pedagogical model. It is also supported by the interdisciplinary comparison of sources from cultural heritage studies, graphic design pedagogy, restoration education and digital heritage research. The reliability of the study is achieved through the transparent description of the analytical stages, the consistent application of selected methods and the clear differentiation between theoretical interpretation, conceptual reconstruction and model construction.

The limitations of the study are associated with its theoretical character. The proposed pedagogical model has not yet been empirically tested within a specific educational programme. Therefore, the results should be regarded as a conceptual basis for further research and practical implementation. Future studies may include expert evaluation of the model, comparative analysis of educational curricula, pilot implementation in restoration or heritage design courses, assessment of students' visual-project competence and empirical analysis of project-based learning outcomes.

Thus, the chosen methodology corresponds to the aim of the study and makes it possible to analyse 2D and 3D graphic design as a pedagogical basis for forming visual-project competence. The combination of theoretical analysis, conceptual reconstruction and pedagogical modelling

provides a foundation for interpreting graphic design as an integrated professional language of restoration documentation, heritage reconstruction and cultural revitalisation.

Literature Review

The problem of forming visual-project competence in 2D/3D graphic design for restorers, reconstructors and revitalisation specialists in cultural heritage is situated at the intersection of several research fields: cultural heritage education, graphic design pedagogy, digital heritage, 3D documentation, virtual archaeology, HBIM technologies and design thinking. The reviewed literature demonstrates that contemporary cultural heritage training can no longer be limited to historical, conservation-related or technological knowledge. It increasingly requires the formation of a visual and project-based mode of professional thinking that enables future specialists to analyse, document, model, reconstruct and communicate heritage objects through integrated 2D and 3D visual systems.

A general educational framework for this transformation is provided by contemporary approaches to culture and arts education. The UNESCO framework for culture and arts education emphasises the need to integrate culture, creativity, critical thinking, digital literacy and professional competencies into educational processes (*UNESCO, 2024*). This position is important for the present study because it confirms that cultural heritage education should not be reduced to the passive transmission of historical knowledge. It should develop the learner's capacity to interpret, create, design, communicate and act in complex cultural environments. In relation to the training of restorers, reconstructors and revitalisation specialists, this means that visual competence must be regarded as an essential component of professional preparation rather than as an optional artistic skill.

The pedagogical significance of visual-project competence can also be substantiated through design thinking. Cross (*2011*) interprets design thinking as a specific way of understanding and solving problems through visualisation, modelling, iterative reasoning and project-based decision-making. This approach is directly relevant to cultural heritage education, since restoration, reconstruction and revitalisation are not linear technical procedures. They involve the interpretation of incomplete data, the comparison of hypotheses, the modelling of possible solutions and the communication of project decisions to different audiences. Therefore, the training of heritage specialists should include not only knowledge of materials, styles and historical periods, but also the ability to think visually and projectively.

The foundations of 2D visual communication are important for understanding the first layer of visual-project competence. Lupton and Phillips (*2015*) show that graphic design is based on principles of hierarchy, composition, scale, rhythm, structure, contrast, modularity and visual organisation. These principles are relevant not only to general graphic design, but also to restoration and heritage documentation. In the context of cultural heritage, 2D graphic design provides the language for damage maps, restoration charts, object passports, analytical diagrams, typological schemes, explanatory infographics, exhibition graphics and project boards. It allows complex information about an object's condition, structure, losses, historical layers and proposed interventions to be organised in a clear and professionally communicative form.

However, the reviewed literature shows that contemporary heritage work increasingly requires transition from 2D representation to 3D documentation and modelling. Remondino and Rizzi

(2010) analyse reality-based 3D documentation of natural and cultural heritage sites, showing that digital recording technologies make it possible to produce accurate spatial representations of heritage objects. Their work is significant because it demonstrates that 3D visualisation is not merely an illustrative tool. It serves as a method of documentation, analysis and preservation. For educational purposes, this means that future specialists should be trained to understand how three-dimensional data are generated, interpreted and used in restoration and reconstruction processes.

This line of research is further developed by Stylianidis and Remondino (2016), who systematise methods of 3D recording, documentation and management of cultural heritage. Their work demonstrates that 3D technologies are becoming a core element of professional heritage practice, including surveying, modelling, monitoring, conservation planning and public presentation. In the context of the present study, this supports the conclusion that 3D graphic design should be included in cultural heritage curricula not as a narrow technical module, but as part of an integrated visual-project competence. Students must learn not only how to produce 3D models, but also how to evaluate their accuracy, interpret their cultural meaning and use them in professional decision-making.

A specific technological direction within digital heritage education is represented by Historic Building Information Modelling. Murphy et al. (2013) introduce the concept of Historic Building Information Modelling as an approach that adds semantic and historical intelligence to laser- and image-based surveys. This is important because HBIM combines geometry, historical information, materials, construction logic and conservation data within a structured digital model. López et al. (2018), in their review of heritage building information modelling, further demonstrate that H-BIM has become an essential tool for the documentation, management, conservation and analysis of historic buildings. These studies are directly relevant to the formation of visual-project competence, since they show that future heritage specialists must be able to work not only with visual form, but also with data-rich digital models.

In pedagogical terms, HBIM changes the status of 3D design in heritage education. A 3D model is no longer simply a visual representation of an object. It becomes an analytical environment that connects geometry, chronology, material data, structural information and conservation decisions. This requires students to develop a combined competence: spatial thinking, digital modelling, historical interpretation, data structuring and project communication. Therefore, the integration of HBIM into cultural heritage education supports the shift from isolated digital skills to systemic visual-project training.

Another important research line is associated with virtual archaeology and the principles of digital reconstruction. The Seville Principles define methodological and ethical requirements for virtual archaeology, including scientific transparency, documentation of sources, differentiation between evidence and hypothesis, and the need for intellectual and technical rigour in virtual reconstructions (ICOMOS, 2017). These principles are particularly significant for the present study because they demonstrate that 3D reconstruction in cultural heritage is not a free artistic fantasy. It is a research-based visual hypothesis that must be grounded in evidence, clearly documented and critically interpreted. This has direct pedagogical implications: students must learn to distinguish between documented reconstruction, hypothetical modelling and interpretative visualisation.

The broader theoretical field of digital cultural heritage also provides an important basis for the study. Cameron and Kenderdine (2007) analyse digital cultural heritage as a field requiring

critical reflection on representation, interpretation, authenticity, mediation and user experience. Their work shows that digital heritage is not limited to the technical digitisation of objects. It involves the transformation of the ways in which heritage is perceived, accessed and communicated. Kalay et al. (2007) similarly emphasise that new media create new forms of heritage interpretation and engagement, changing the relationship between cultural objects, digital environments and audiences. These approaches are important because they allow 2D/3D graphic design to be understood as part of a broader communicative and interpretative system.

For the training of revitalisation specialists, this digital and communicative dimension is especially important. Revitalisation requires not only the preservation or reconstruction of an object, but also the restoration of its social, cultural, educational or public function. In this context, graphic design becomes a tool of cultural reactivation. 2D design may support visual identity, navigation, interpretation panels, educational materials and public communication. 3D design may support future-use scenarios, spatial simulations, virtual exhibitions, immersive environments and public presentation of revitalisation concepts. Therefore, the visual-project competence of revitalisation specialists should include the ability to connect heritage analysis with contemporary forms of cultural communication.

A comparison of the reviewed sources shows that each research field explains a specific aspect of the problem. UNESCO (2024) provides the general educational framework for integrating culture, creativity and digital literacy. Cross (2011) substantiates design thinking as a mode of project-based reasoning. Lupton and Phillips (2015) clarify the principles of 2D visual communication. Remondino and Rizzi (2010), as well as Stylianidis and Remondino (2016), demonstrate the professional significance of 3D documentation in cultural heritage. Murphy et al. (2013) and López et al. (2018) reveal the potential of HBIM as a data-rich model for heritage analysis and management. ICOMOS (2017) establishes methodological principles for responsible virtual reconstruction. Cameron and Kenderdine (2007), together with Kalay et al. (2007), provide a critical framework for understanding digital cultural heritage and new media interpretation.

At the same time, the literature reveals a research gap. Existing studies provide substantial theoretical and methodological foundations for design thinking, graphic design, digital heritage, 3D documentation, HBIM and virtual reconstruction. However, these approaches are often developed separately. Graphic design pedagogy is rarely integrated systematically with restoration education. 3D modelling is frequently treated as a technical skill rather than as part of a broader visual-project competence. HBIM is usually discussed in relation to documentation and management, but not always in relation to the pedagogical formation of future specialists. Digital heritage studies focus on interpretation and mediation, but they do not always define the educational structure required for training restorers, reconstructors and revitalisation specialists.

This gap determines the need for the present study. A pedagogical model is required that would integrate 2D graphic design, 3D modelling, restoration documentation, digital reconstruction, HBIM logic and revitalisation communication into a unified educational framework. Within such a framework, visual-project competence can be understood as an integrated professional ability that includes analytical observation, graphic structuring, spatial modelling, reconstruction reasoning, digital documentation and communicative presentation. This competence is essential for preparing specialists who are capable not only of preserving cultural

heritage, but also of interpreting, reconstructing and revitalising it through contemporary visual and digital means.

Thus, the reviewed literature confirms the relevance of studying visual-project competence in 2D/3D graphic design as a pedagogical basis for training restorers, reconstructors and revitalisation specialists. The theoretical synthesis of the selected sources makes it possible to move from a fragmented understanding of visual tools to a systemic pedagogical model in which graphic design becomes a professional language of heritage analysis, reconstruction and cultural revitalisation.

Results

1. 2D Graphic Design as an Analytical Language of Restoration Documentation

The study established that 2D graphic design performs a fundamental analytical function in the professional training of restorers, reconstructors and revitalisation specialists. In cultural heritage education, 2D design should not be regarded merely as a means of visual presentation or aesthetic formatting. It functions as a professional language through which the condition, structure, damage, historical layers and transformation potential of a heritage object can be documented, classified and interpreted.

The results show that the formation of visual-project competence begins with the ability to translate complex information about a cultural heritage object into clear graphic systems. These systems include damage maps, restoration diagrams, typological schemes, material charts, chronological layers, object passports, analytical drawings, explanatory infographics and project boards. Such visual materials make it possible to organise information about the object in a structured and communicative form. In this sense, 2D graphic design contributes to the development of analytical clarity, visual hierarchy and professional accuracy.

The pedagogical significance of 2D graphic design lies in the fact that it teaches students to see a heritage object not only as an artistic or historical artefact, but also as a system of visible and hidden relations. Through graphic analysis, students learn to identify structural elements, distinguish between original and later layers, visualise losses, mark interventions, explain deterioration processes and present restoration logic. This corresponds to the general principles of visual communication, in which hierarchy, contrast, composition, modularity and clarity are central to the organisation of meaning (*Lupton & Phillips, 2015*).

The study also showed that 2D visualisation supports the transition from descriptive knowledge to professional interpretation. A student who creates a damage map or restoration diagram is not simply reproducing the external appearance of an object. They are making analytical decisions: what should be highlighted, what should be classified, how information should be structured, and how the visual material should communicate the professional logic of intervention. Thus, 2D graphic design becomes a pedagogical tool for developing observation, classification, visual thinking and professional responsibility.

Therefore, the first result of the study is the substantiation of 2D graphic design as an analytical language of restoration documentation. It forms the basic level of visual-project competence by developing students' ability to record, organise, interpret and communicate information about cultural heritage objects in a visually structured form.

2. 3D Graphic Design as a Tool for Reconstruction, Spatial Modelling and Digital Heritage Analysis

The second result of the study concerns the role of 3D graphic design in the training of cultural heritage specialists. The analysis showed that 3D modelling should be understood not merely as a technical skill or illustrative instrument, but as a method of spatial analysis, reconstruction reasoning and digital heritage interpretation. In contrast to 2D visualisation, which primarily structures information on a plane, 3D design allows students to work with volume, scale, spatial relations, geometry, materiality and hypothetical reconstruction scenarios.

The importance of 3D design is especially evident in the fields of reconstruction and restoration education. Cultural heritage objects are often preserved in a damaged, fragmented or transformed state. In such cases, 3D modelling enables students to test reconstruction hypotheses, compare historical sources, reconstruct lost elements, analyse proportions, simulate visual integrity and evaluate possible restoration or revitalisation solutions. This makes 3D design a powerful pedagogical instrument for connecting historical knowledge, spatial thinking and project-based decision-making.

Reality-based 3D documentation has become one of the central directions in contemporary cultural heritage practice. Remondino and Rizzi (2010) demonstrate that 3D documentation technologies make it possible to create accurate spatial records of heritage objects, while Stylianidis and Remondino (2016) emphasise the importance of 3D recording, documentation and management for conservation and heritage practice. These approaches confirm that future specialists must be trained not only to produce digital models, but also to understand their methodological status, accuracy, limitations and interpretative function.

The results also indicate that 3D graphic design contributes to the development of reconstructive thinking. Reconstruction in heritage education is always connected with uncertainty. Students must learn to distinguish between documented elements, probable reconstructions and hypothetical visualisations. This is especially important in accordance with the principles of virtual archaeology, which require transparency, evidence-based modelling and a clear distinction between scientific data and interpretative assumptions (ICOMOS, 2017). Therefore, 3D design in cultural heritage education should not encourage arbitrary visual fantasy, but should develop disciplined visual reasoning based on sources, measurements, analogies and professional argumentation.

The use of Historic Building Information Modelling further expands the educational potential of 3D design. Murphy et al. (2013) show that HBIM adds semantic and historical intelligence to laser- and image-based surveys, while López et al. (2018) demonstrate that H-BIM is increasingly used for documentation, analysis and management of historic buildings. In pedagogical terms, this means that the 3D model becomes not only an image, but also a structured information environment. Students learn to connect geometry with materials, chronology, construction logic, conservation data and restoration decisions.

Thus, the second result of the study is the substantiation of 3D graphic design as a tool for reconstruction, spatial modelling and digital heritage analysis. It forms a higher level of visual-project competence by developing students' ability to work with spatial data, reconstruction hypotheses, digital models and evidence-based visualisation of cultural heritage.

3. Visual-Project Competence as an Integrated Pedagogical Construct

The third result of the study is the definition of visual-project competence as an integrated pedagogical construct required for the training of restorers, reconstructors and revitalisation

specialists. The analysis showed that this competence cannot be reduced either to artistic ability, technical digital skills or knowledge of design software. It represents a complex professional ability that combines visual thinking, analytical observation, spatial modelling, graphic structuring, digital visualisation, project communication and heritage interpretation.

The structure of visual-project competence includes several interrelated components. The analytical component reflects the ability to observe, classify and visually interpret the condition of a heritage object. The artistic-compositional component concerns the ability to organise visual material clearly, coherently and aesthetically. The technical-digital component includes proficiency in digital tools for 2D graphics, 3D modelling, visualisation and documentation. The reconstructive component reflects the ability to model lost, damaged or hypothetical elements on the basis of evidence. The communicative component is connected with the presentation of restoration, reconstruction or revitalisation concepts to specialists, institutions and public audiences. The project-based component ensures the integration of visual decisions into broader heritage preservation and revitalisation strategies.

This structure shows that visual-project competence is interdisciplinary by nature. It combines pedagogy, graphic design, digital art, restoration theory, heritage studies, architectural visualisation and cultural communication. This corresponds to the logic of design thinking, in which visualisation, modelling and iterative reasoning are regarded as ways of understanding complex problems and developing project solutions (*Cross, 2011*). In cultural heritage education, such thinking is especially important because specialists must work with incomplete evidence, damaged objects, historical uncertainty and the need to justify professional decisions.

The study established that the formation of visual-project competence requires a gradual pedagogical sequence. At the first stage, students should master 2D analytical tools: drawing, diagramming, mapping, visual classification and documentation. At the second stage, they should develop 3D spatial competence: modelling, reconstruction, digital recording and visualisation. At the third stage, they should integrate 2D and 3D tools into project-based tasks connected with restoration, reconstruction or revitalisation. At the fourth stage, they should learn to communicate their project decisions through professional presentations, digital portfolios, exhibition materials and public interpretation.

The results also showed that visual-project competence changes the role of graphic design in cultural heritage curricula. Graphic design should not be placed at the periphery of training as an auxiliary discipline. It should become one of the core methodological components of professional education, since it connects analysis, modelling, communication and project thinking. In this sense, 2D/3D graphic design becomes an educational mechanism for forming a specialist capable of working with cultural heritage as a complex visual, spatial, historical and social system.

Thus, the third result of the study is the development of visual-project competence as an integrated pedagogical category. This competence provides the conceptual basis for uniting 2D design, 3D modelling, restoration documentation, digital reconstruction and revitalisation communication within a single educational model.

4. Pedagogical Model for Integrating 2D/3D Graphic Design into Cultural Heritage Training

The fourth result of the study is the development of a pedagogical model for integrating 2D and 3D graphic design into the training of restorers, reconstructors and revitalisation specialists.

The proposed model is based on the principle that graphic design should be included in the educational process not as a separate technical skill, but as a professional visual language accompanying all stages of work with cultural heritage.

The model includes three main functional levels. The first level is analytical-documentary. At this level, 2D graphic design is used for visual analysis, classification, documentation and explanation of the object's condition. Students learn to prepare drawings, diagrams, damage maps, analytical schemes and visual reports. The aim of this level is to form the ability to see, distinguish, structure and explain the heritage object through graphic means.

The second level is reconstructive-digital. At this level, 3D graphic design is used for spatial modelling, reconstruction hypotheses, digital documentation and simulation of lost or transformed elements. Students work with 3D models, photogrammetry, point clouds, HBIM logic, virtual reconstruction and digital visualisation. The aim of this level is to form the ability to analyse heritage in space, test hypotheses and develop evidence-based visual reconstructions.

The third level is communicative-revitalisation. At this level, 2D and 3D design are used for public communication, museum interpretation, exhibition design, navigation, identity systems, digital storytelling, virtual environments and revitalisation concepts. The aim of this level is to train students to present heritage not only to experts, but also to communities, visitors, institutions and broader audiences. This is particularly important because revitalisation requires the return of cultural, social and educational meaning to heritage objects.

The model demonstrates that restoration, reconstruction and revitalisation require different but interconnected types of visual work. Restoration requires precise documentation and explanation of intervention logic. Reconstruction requires spatial modelling and evidence-based visual hypotheses. Revitalisation requires communicative design, scenario modelling and public interpretation. Therefore, the same visual-project competence functions differently depending on the professional task, but its core structure remains unified.

The proposed model also corresponds to contemporary digital heritage discourse. Cameron and Kenderdine (2007) and Kalay et al. (2007) show that digital heritage changes the ways cultural objects are represented, interpreted and communicated. This confirms that future specialists should be trained not only to preserve heritage, but also to present it responsibly in digital and hybrid environments. At the same time, the model retains the importance of traditional 2D analytical graphics, since digital technologies do not eliminate the need for visual clarity, graphic discipline and professional documentation.

The study established several pedagogical conditions for implementing the model. The first condition is interdisciplinarity: courses in graphic design, restoration, heritage studies, digital modelling and project communication should be coordinated rather than taught separately. The second condition is project-based learning: students should work on real or modelled heritage cases. The third condition is evidence-based visualisation: all reconstruction and revitalisation proposals should be justified through sources, measurements and analytical reasoning. The fourth condition is digital and ethical literacy: students should understand both the possibilities and limitations of digital representation. The fifth condition is public communication: students should learn to translate professional visual materials into accessible forms for non-specialist audiences.

Thus, the fourth result of the study is the development of a pedagogical model that integrates 2D and 3D graphic design into cultural heritage training through analytical-documentary,

reconstructive-digital and communicative-revitalisation levels. This model makes it possible to overcome the fragmentation of educational content and to form specialists capable of analysing, modelling, reconstructing and revitalising cultural heritage through contemporary visual and digital means.

Discussion

The results of the study demonstrate that visual-project competence in 2D/3D graphic design should be considered one of the key pedagogical foundations for the contemporary training of restorers, reconstructors and revitalisation specialists in cultural heritage. This conclusion is significant because it changes the status of graphic design in cultural heritage education. Graphic design is no longer interpreted as an auxiliary artistic discipline or as a technical means of presenting already formulated decisions. Instead, it appears as an integrated professional language through which future specialists analyse, document, model, reconstruct, interpret and communicate cultural heritage objects.

The first important result concerns the analytical function of 2D graphic design. The study showed that 2D design provides the basic visual language for restoration documentation and professional communication. Damage maps, restoration diagrams, chronological schemes, typological tables, object passports and analytical drawings allow students to translate complex information about a heritage object into structured visual form. This finding is consistent with the principles of visual communication described by Lupton and Phillips (2015), who emphasise the importance of hierarchy, composition, contrast, modularity and clarity in the organisation of visual meaning. However, the present study extends this understanding to the field of restoration and cultural heritage education by showing that graphic clarity is not only an aesthetic requirement, but also a professional condition for accurate analysis and communication.

The second result concerns the role of 3D graphic design as a tool for reconstruction, spatial modelling and digital heritage analysis. The findings confirm that 3D modelling is not merely a means of visual illustration. It functions as a research and project instrument that enables the modelling of lost elements, testing of reconstruction hypotheses, analysis of spatial relations and simulation of revitalisation scenarios. This corresponds to the position of Remondino and Rizzi (2010), who demonstrate the importance of reality-based 3D documentation for cultural heritage, and to the work of Stylianidis and Remondino (2016), who consider 3D recording and documentation as essential components of heritage management. The present study develops these approaches in the pedagogical direction by showing that 3D design should be taught as a component of professional reasoning rather than as a purely technical software skill.

The results also confirm the importance of Historic Building Information Modelling for the training of heritage specialists. Murphy et al. (2013) show that HBIM adds semantic and historical intelligence to laser- and image-based surveys, while López et al. (2018) demonstrate the significance of H-BIM for the documentation, conservation and management of historic buildings. The present study supports these conclusions and specifies their pedagogical meaning. In the educational process, HBIM logic makes it possible to connect geometry, materials, chronology, construction data, conservation decisions and visual communication. Therefore, students must learn not only to create digital models, but also to understand the informational, historical and analytical structure behind them.

The third major finding is the definition of visual-project competence as an integrated pedagogical construct. This competence includes analytical, artistic-compositional, technical-digital, reconstructive, communicative and project-based components. Such a structure corresponds to the logic of design thinking, in which visualisation, modelling and iterative project reasoning are considered fundamental forms of professional problem-solving (*Cross, 2011*). In the context of cultural heritage education, this means that future specialists should be trained to work with uncertainty, incomplete data, damaged objects, historical hypotheses and public interpretation. Visual-project competence allows students to connect observation, analysis, modelling and communication into a single professional process.

The fourth result concerns the proposed pedagogical model for integrating 2D and 3D graphic design into cultural heritage training. The model includes three functional levels: analytical-documentary, reconstructive-digital and communicative-revitalisation. This structure reflects the logic of professional work with cultural heritage. At the analytical-documentary level, students learn to document and interpret the existing condition of an object. At the reconstructive-digital level, they model lost or transformed elements and develop evidence-based reconstruction hypotheses. At the communicative-revitalisation level, they use visual means to present heritage meanings, design public interpretation and support the return of cultural, social or educational function to heritage objects.

This model corresponds to contemporary research on digital cultural heritage. Cameron and Kenderdine (*2007*) argue that digital heritage requires critical reflection on representation, mediation, authenticity and user experience. Kalay et al. (*2007*) similarly emphasise that new media transform the ways in which cultural heritage is interpreted and communicated. The present study develops this position by showing that digital and visual technologies should be incorporated into the educational process not only as instruments of presentation, but also as tools of professional thinking. In this respect, 2D/3D design becomes a pedagogical bridge between restoration knowledge, digital modelling and public communication.

The results are also consistent with the principles of responsible virtual reconstruction. The Seville Principles underline the need for transparency, scientific validity and clear differentiation between documented evidence and hypothetical reconstruction in virtual archaeology (*ICOMOS, 2017*). The present study confirms the pedagogical importance of these principles. Students should understand that 3D reconstruction in cultural heritage is not free artistic speculation. It is a visual hypothesis that must be based on evidence, documented sources, measurements, analogies and transparent interpretation. Therefore, training in 3D graphic design must include methodological and ethical components.

The theoretical contribution of the study lies in the development of the concept of visual-project competence as an educational category in cultural heritage pedagogy. Existing studies discuss graphic design, digital heritage, 3D documentation, HBIM and virtual reconstruction as important but often separate areas. The present study integrates these areas into a single pedagogical construct. It demonstrates that visual-project competence can serve as a conceptual basis for organising the training of restorers, reconstructors and revitalisation specialists. This contributes to the development of heritage education by shifting attention from separate digital or graphic skills to the formation of an integrated professional mode of thinking.

The practical significance of the study lies in the possibility of applying the proposed model in educational programmes related to restoration, reconstruction, museum design, digital heritage, architectural heritage and urban revitalisation. The model may be used for curriculum development, course design, project-based learning and assessment of student competencies. For example, educational programmes may include modules on 2D restoration documentation, 3D modelling of heritage objects, HBIM-based analysis, virtual reconstruction, exhibition graphics, heritage navigation, digital storytelling and visual presentation of revitalisation concepts.

The proposed approach is also useful for designing learning outcomes. Instead of describing student achievements only in terms of knowledge of restoration theory or proficiency in software, programmes may define outcomes through visual-project competence. Such outcomes may include the ability to analyse the condition of heritage objects visually, prepare professional documentation, distinguish between evidence and hypothesis in reconstruction, create digital models, communicate restoration decisions and design revitalisation scenarios for different audiences.

The study has several limitations. The first limitation is its theoretical character. The proposed model is based on conceptual analysis, comparative interpretation and pedagogical modelling, but it has not yet been empirically tested in a specific educational programme. Therefore, the results should be considered as a theoretical framework requiring further verification. Future studies should include pilot implementation of the model in restoration, reconstruction or heritage design courses.

The second limitation concerns the selected source base. The study uses key works on design thinking, graphic design, digital heritage, 3D documentation, HBIM and virtual reconstruction. However, the inclusion of a broader range of empirical studies on student learning, design pedagogy, professional restoration training and digital competency assessment would allow the model to be further refined. In particular, future research should examine how students actually acquire visual-project competence and which pedagogical methods are most effective.

The third limitation is associated with the diversity of cultural heritage education itself. Training requirements may differ depending on whether the programme focuses on architectural restoration, museum studies, archaeological reconstruction, urban revitalisation, digital heritage or exhibition design. Therefore, the proposed model should not be understood as a rigid universal scheme. It should be adapted to specific institutional, national, disciplinary and professional contexts.

The fourth limitation concerns the rapid development of digital technologies. Tools for 3D modelling, photogrammetry, HBIM, virtual reality, augmented reality and artificial intelligence are changing quickly. This means that the digital component of visual-project competence requires constant updating. Future research should analyse how emerging technologies transform the structure of professional competencies in heritage education and how curricula can remain flexible without losing methodological rigour.

Further research may develop in several directions. First, empirical studies are needed to evaluate the effectiveness of integrating 2D/3D graphic design into cultural heritage curricula. Such studies may include student portfolios, project assessment, expert evaluation, interviews with educators and comparison of learning outcomes before and after the implementation of the model. Secondly, it would be useful to develop diagnostic criteria for assessing visual-project competence.

These criteria may include analytical accuracy, graphic clarity, spatial modelling ability, evidence-based reconstruction, digital literacy, communicative effectiveness and ethical awareness.

Thirdly, future research may focus on project-based learning in cultural heritage education. Since restoration, reconstruction and revitalisation are practical and interdisciplinary fields, educational tasks should be based on real or modelled heritage cases. Students may work with damaged objects, historical documentation, archival images, laser scanning data, photogrammetry materials, museum collections or revitalisation scenarios. Such tasks would make it possible to test how visual-project competence develops in practice.

Fourthly, further research should examine the relationship between visual-project competence and public communication of heritage. Revitalisation specialists must not only analyse and model heritage objects, but also communicate their value to communities, visitors, institutions and decision-makers. Therefore, visual design should be studied as a tool for public engagement, museum interpretation, cultural participation and heritage advocacy.

Overall, the discussion confirms that visual-project competence in 2D/3D graphic design is a necessary component of contemporary cultural heritage education. It allows future restorers, reconstructors and revitalisation specialists to work with heritage objects as complex visual, spatial, historical and social systems. The integration of 2D documentation, 3D modelling, HBIM logic, virtual reconstruction and communicative design makes it possible to overcome the fragmentation of specialist training and to prepare professionals capable of analysing, reconstructing and revitalising cultural heritage through contemporary visual and digital means.

Conclusion

The study conducted made it possible to establish that visual-project competence in 2D/3D graphic design is a necessary pedagogical foundation for the contemporary training of restorers, reconstructors and revitalisation specialists in the field of cultural heritage. The increasing complexity of professional work with heritage objects requires specialists to possess not only historical, artistic, technological and conservation-related knowledge, but also the ability to analyse, model, document, reconstruct and communicate heritage through advanced visual and digital means.

The aim of the study, which consisted in developing and theoretically substantiating a pedagogical model for integrating 2D and 3D graphic design into the training of cultural heritage specialists, was achieved. The analysis showed that graphic design should not be considered an auxiliary or purely illustrative discipline. In the context of restoration, reconstruction and revitalisation, it functions as an integrated professional language that connects visual analysis, spatial modelling, evidence-based reconstruction, digital documentation and public communication.

The research objectives were consistently fulfilled. The role of 2D and 3D graphic design in contemporary cultural heritage practice was analysed. The concept of visual-project competence was clarified as an integrated pedagogical category. The main pedagogical functions of graphic design in the training of restorers, reconstructors and revitalisation specialists were identified. The structural components of visual-project competence were determined. A theoretical pedagogical model for integrating 2D and 3D graphic design into cultural heritage curricula was proposed.

The main result of the study is the substantiation of visual-project competence as a complex professional ability that includes analytical, artistic-compositional, technical-digital, reconstructive, communicative and project-based components. The analytical component enables students to identify, classify and visually interpret the condition of heritage objects. The artistic-compositional component ensures visual clarity, hierarchy and coherence of professional materials. The technical-digital component forms the ability to use contemporary software and digital tools for 2D and 3D visualisation. The reconstructive component develops evidence-based modelling of lost, damaged or hypothetical elements. The communicative component supports the presentation of restoration, reconstruction and revitalisation concepts to professional and public audiences. The project-based component integrates visual decisions into broader strategies of heritage preservation and cultural revitalisation.

The study demonstrated that 2D graphic design forms the basic analytical language of restoration documentation. It is essential for damage maps, restoration schemes, typological diagrams, object passports, explanatory infographics and project boards. Through 2D design, students learn to organise complex information about a heritage object and present it in a clear, structured and professionally meaningful form.

The study also showed that 3D graphic design forms a higher level of visual-project competence. It enables spatial modelling, digital documentation, reconstruction hypotheses, simulation of lost elements and visualisation of revitalisation scenarios. In this sense, 3D modelling is not only a technical instrument, but also a method of professional reasoning that allows future specialists to work with uncertainty, incomplete data and complex spatial structures.

The proposed pedagogical model includes three functional levels: analytical-documentary, reconstructive-digital and communicative-revitalisation. At the analytical-documentary level, students master 2D tools for visual analysis and restoration documentation. At the reconstructive-digital level, they use 3D modelling, digital documentation and evidence-based reconstruction methods. At the communicative-revitalisation level, they apply visual design to museum interpretation, public presentation, digital storytelling, exhibition graphics, navigation systems and revitalisation concepts.

The theoretical significance of the study lies in the development of visual-project competence as a pedagogical category in cultural heritage education. The article expands the understanding of graphic design by interpreting it not as a peripheral technical skill, but as a methodological component of professional training. This approach makes it possible to connect design thinking, 2D visual communication, 3D modelling, restoration documentation, digital reconstruction and revitalisation into a unified educational framework.

The practical significance of the study consists in the possibility of applying the proposed model in university courses, professional training programmes, interdisciplinary curricula and project-based educational modules. The model may be used in restoration education, heritage reconstruction, museum design, digital heritage, architectural heritage, exhibition design, urban revitalisation and cultural project management. It may also support the development of student portfolios, assessment criteria, practical assignments and digital visualisation tasks.

At the same time, the study has several limitations. Its results are theoretical and require further empirical verification. The proposed model should be tested in educational programmes through pilot courses, student projects, expert evaluation and comparative analysis of learning outcomes.

Further research may also focus on diagnostic criteria for assessing visual-project competence and on the influence of emerging technologies, including artificial intelligence, virtual reality, augmented reality and advanced HBIM systems, on the training of cultural heritage specialists.

In conclusion, the article demonstrates that 2D/3D graphic design should be systematically integrated into cultural heritage education as a core pedagogical mechanism for forming visual-project competence. Such integration makes it possible to overcome the fragmentation of specialist training and to prepare restorers, reconstructors and revitalisation specialists capable of working with cultural heritage as a complex visual, spatial, historical, technological and social system.

Conflict of Interests

The author declares that there is no conflict of interests that could have influenced the objectivity of the study, the interpretation of the results or the presentation of the conclusions. The article was prepared independently, without external funding, institutional pressure or the involvement of organisations or individuals with a direct financial, personal or professional interest in the outcomes of the research.

The study is theoretical in nature and is based on the analysis of scholarly literature in the fields of cultural heritage education, graphic design pedagogy, digital heritage, restoration documentation, 3D modelling, HBIM, virtual reconstruction and revitalisation studies. The selection and interpretation of sources were performed in accordance with the aim, objectives and methodological framework of the article.

The author confirms that there were no financial, institutional or personal circumstances that could be interpreted as influencing the research position, methodological approach, analytical procedure or conclusions of the study. All results presented in the article are based on independent theoretical analysis, conceptual systematisation and pedagogical modelling.

Thus, the present declaration confirms compliance with the principles of academic integrity, publication transparency and ethical standards of scholarly research.

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