

From Craft Traditions to Digital Design: A Six-Stage Historical-Pedagogical Model of Design and Technology Education in Ukraine

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Abstract

This article develops a six-stage historical-pedagogical model of the development of Design and Technology Education in Ukraine. It addresses a gap in international design education research by showing how national trajectories of craft, art-industrial training, avant-garde experimentation, technical aesthetics, ethnodesign and digital innovation can be interpreted as interrelated educational logics rather than isolated historical episodes. The study is a conceptual historical-pedagogical investigation based on historical analysis, cultural analysis, systematic interpretation and comparative educational reasoning. The model identifies six stages: traditional craft-based education; art-industrial education; avant-garde constructive-modernist education; technical-aesthetic and industrial design education; ethnodesign and national-cultural renewal; and digital-innovative, STEAM-oriented design and technology education. Each stage contributes a specific pedagogical layer: craft-symbolic form-making, material and production literacy, experimental visual communication, functional and ergonomic reasoning, culturally responsive design, and digital modelling and prototyping. The article argues that contemporary design and technology education is strengthened when digital transformation is connected with cultural memory, material knowledge, project culture and responsible innovation. The proposed model offers a comparative framework for researchers and curriculum developers seeking to connect cultural heritage, technological capability and future-oriented design learning in different national contexts.

Keywords

design and technology education, Ukraine, historical-pedagogical model, ethnodesign, digital design, STEAM education

Introduction

Design and Technology Education has become a strategic area of contemporary schooling and teacher education because it connects practical making with design thinking, technological literacy, sustainability, creativity and responsible innovation. In many countries, this field is presented as a forward-looking curriculum area: learners are expected to define problems, generate ideas, prototype, test, evaluate and improve products, services or systems. However, every national version of Design and Technology Education is also historically layered. Behind modern concepts such as design thinking, STEAM, maker education, digital fabrication and human-centred innovation lie older traditions of craft apprenticeship, art-industrial training, technical drawing, applied art, material culture and professional design education.

The Ukrainian case is especially important for such a historical-pedagogical analysis. Ukrainian design education did not emerge suddenly as a modern imported discipline. It developed at the intersection of folk crafts, decorative and applied arts, ornament, art-industrial schools, avant-garde experimentation, technical aesthetics, labour and technology education, ethnodesign, digital modelling and contemporary project-based learning. The subject field now described as design and technology can therefore be interpreted as a continuation of a long educational trajectory in which cultural heritage and technological activity are not opposed but interdependent.

The central problem addressed in this article is the absence of an internationally legible model that explains the historical continuity of Ukrainian design and technology education. Existing studies often examine separate aspects: traditional crafts, Ukrainian decorative art, the Ukrainian avant-garde, professional designer training, industrial design, ethnodesign or digital design. These studies are important, but they do not always show how the different layers form an educational sequence. A conceptual model is needed to show how these layers contributed to the pedagogical formation of design capability, project culture and technological literacy.

The purpose of this article is to develop and justify a six-stage historical-pedagogical model of Design and Technology Education development in Ukraine. The article proposes that Ukrainian experience can be understood through six interrelated stages: traditional craft-based education; art-industrial education; avant-garde constructive-modernist education; technical-aesthetic and industrial design education; ethnodesign and national-cultural renewal; and digital-innovative STEAM-oriented education. These stages do not represent rigid chronological compartments. They are historical layers whose pedagogical meanings continue to influence contemporary practice.

The article contributes to the international field of Design and Technology Education in three ways. First, it introduces a Ukrainian historical case in a form that can be compared with other national trajectories. Second, it shifts the discussion from a simple history of design institutions to a pedagogical model of educational logics and competencies. Third, it argues that contemporary digital design education is more effective when it is connected with cultural memory, material knowledge and historical forms of project activity rather than treated only as a set of software skills.

Literature Review and Conceptual Background

International research in Design and Technology Education commonly stresses the integration of creativity, problem solving, practical making, human-centred design, technological knowledge and reflection. The field is not reducible to craft lessons, engineering exercises or digital software training. It is a curriculum area in which learners develop the capacity to move between need, idea, material, prototype, evaluation and improvement. This logic is close to design thinking, but it is grounded in the educational tradition of learning through designing and making (Archer, 1979; Bartholomew et al., 2023; Design & Technology Association, 2022; Meyer & Norman, 2020).

The literature on design thinking has helped to articulate the iterative and human-centred dimensions of design learning. Cross (2006), Dorst (2011), Brown (2008) and other authors have shown that design involves particular forms of reasoning: framing problems, working with

ambiguity, visualising possible futures and making knowledge visible through models and prototypes. These ideas are relevant to Design and Technology Education because learners do not simply apply fixed knowledge; they generate and test possible solutions. In educational settings, design thinking must be adapted to learners' developmental level, cultural context and available materials.

A second relevant strand is project-based and maker-oriented learning. This literature emphasises authentic tasks, collaboration, prototyping, iteration, reflection and public demonstration of learning outcomes. In this respect, Design and Technology Education differs from both purely theoretical science learning and purely aesthetic art practice. It requires the learner to connect intention, function, construction, material and user experience. Project culture is therefore a useful concept for analysing the historical development of design education: it describes a learner's capacity to transform an idea into a meaningful, functional and communicative product (Dewey, 1938; Jia et al., 2023).

A third strand concerns STEAM education. STEAM expands STEM by integrating art, design, creativity and cultural meaning into science, technology, engineering and mathematics. This is important for the Ukrainian case because many historical forms of design education were already interdisciplinary: crafts combined material knowledge and symbolic meaning; art-industrial schools connected drawing, technology and production; the avant-garde connected visual language and social transformation; and contemporary digital design connects coding, modelling, communication, user experience and cultural interpretation (UNESCO, 2020).

Historical theories of art-industrial education are also essential. Gottfried Semper's theory of practical aesthetics, later translated and discussed in relation to technical and tectonic arts, is significant because it connects form, material, technique and cultural style. Semper's interpretation of textile, ceramic, tectonic and stereotomic arts provides a useful conceptual background for understanding why craft and applied art are not peripheral to design education. They are historical sources of material thinking and form-making. In European art-industrial education, such ideas helped to bridge craft traditions and modern design pedagogy (Semper, 2004; Orshanskyi & Sylko, 2016).

The Bauhaus is another key international reference point. Its preliminary courses, workshops, material experiments and integration of art, craft and industry shaped twentieth-century design education. The Bauhaus model demonstrated that modern design learning could integrate artistic experimentation, technical skill, workshop practice and social purpose. Although Ukraine had its own trajectory, the broader European transition from craft and applied art to modern design education provides an important comparative context (Gropius, 1965; Itten, 1975; Moholy-Nagy, 1947).

Ukrainian scholarship on design education, ethnodesign, decorative and applied arts, technical aesthetics and the Ukrainian avant-garde provides the immediate source base for the model proposed here. Ukrainian authors have analysed continuous design education, the role of folk crafts and ornaments, art-industrial institutions, the development of professional design, and the educational potential of ethnodesign. However, the Ukrainian field still needs a model that translates these historical resources into a structure understandable to international readers in Design and Technology Education (Brovchenko, 2022, 2024; Danilenko, 2006; Prusak, 2017; Shmagalo, 2005; Tymenko, 2010).

Ethnodesign is especially significant. It should not be reduced to decorative quotation or the superficial use of national motifs. In the Ukrainian context, ethnodesign can be understood as a design-pedagogical practice that connects cultural heritage, local materials, regional traditions, visual symbolism, contemporary form-making and identity-oriented creativity. This connects the Ukrainian historical experience with current international discussions of culturally responsive pedagogy, sustainability and place-based education.

The literature therefore indicates a research gap. International Design and Technology Education has strong concepts of design thinking, project work, technological capability and STEAM integration. Ukrainian research has rich historical and cultural material. What is missing is a conceptual bridge between these fields: a model that presents Ukrainian historical experience not as a local catalogue of events, but as a sequence of educational logics relevant for comparative research.

Methodology

This article is a conceptual historical-pedagogical study. It does not report a classroom experiment or a statistical survey. Its purpose is to construct an analytical model from historical, cultural and pedagogical sources. Such a methodology is appropriate where the research object is not a single institution or intervention but the long-term formation of an educational field.

Four methodological procedures were used. First, historical-pedagogical analysis was used to identify major stages in the development of design-related education in Ukraine. This included attention to craft traditions, art-industrial schooling, avant-garde experimentation, technical aesthetics, ethnodesign and digital design. Second, cultural analysis was used to interpret design education as a carrier of symbols, values, national identity and local memory. Third, systematic analysis was used to connect the stages into a model rather than a list of isolated periods. Fourth, comparative educational reasoning was used to formulate implications for international research in Design and Technology Education.

The unit of analysis is the educational logic of each historical stage. By educational logic, the article means the dominant relationship between learner, material, technology, form, cultural meaning and social purpose. For example, the traditional craft-based stage is not defined only by date; it is defined by apprenticeship, embodied knowledge, continuity of form, symbolic ornament and local material practices. The digital-innovative stage is not defined only by computers; it is defined by modelling, prototyping, user experience, networked collaboration and the integration of STEAM competencies.

The model is therefore interpretive rather than purely chronological. The stages overlap, and earlier layers remain active within later ones. Craft knowledge persists in ethnodesign and sustainable material practice. Art-industrial thinking persists in workshop-based education. Avant-garde experimentation persists in visual communication and design thinking. Technical aesthetics persists in ergonomic and functional design. This layered interpretation is important because Design and Technology Education is never only a present-oriented discipline; it is shaped by inherited practices of making, drawing, modelling and cultural interpretation.

The validity of the proposed model rests on three criteria: historical recognisability, pedagogical coherence and comparative usefulness. Historical recognisability means that each stage

corresponds to identifiable tendencies in Ukrainian design-related education. Pedagogical coherence means that each stage contributes a distinct learning logic. Comparative usefulness means that the model can be used by researchers in other countries to compare their own trajectories of design and technology education.

Results: The Six-Stage Historical-Pedagogical Model

The result of the analysis is a six-stage model of the development of Design and Technology Education in Ukraine. The model is summarised in Table 1 and then discussed stage by stage. The stages are not intended as a rigid periodisation that excludes regional variation. Rather, they provide an analytical framework for interpreting continuity and transformation in the educational development of design capability.

Table 1. Six-stage historical-pedagogical model of Design and Technology Education development in Ukraine.

Stage	Historical-pedagogical focus	Dominant educational logic	Contribution to Design and Technology Education
1. Traditional craft-based	Folk crafts, family/community apprenticeship, decorative and applied arts	Embodied material knowledge, symbolic form-making, continuity of local practices	Manual intelligence, material sensitivity, ornament literacy, cultural meaning
2. Art-industrial	Drawing schools, workshops, art-industrial institutions, relation between art and production	Formalisation of drawing, composition, material processing and production literacy	Connection between form, material, technique and manufacturability
3. Avant-garde constructive-modernist	Experimental visual culture, construction, typography, poster and graphic communication	Problem reframing, experimentation, abstraction and visual communication	Creative risk, design thinking, collaborative and communicative project culture
4. Technical-aesthetic and industrial	Technical aesthetics, industrial design, ergonomics, standardisation and functional analysis	Functional, ergonomic and production-oriented reasoning	Usability, constraints, systems thinking and product evaluation
5. Ethnodesign and national-cultural renewal	Reinterpretation of heritage, ornaments, regional crafts and cultural identity after independence	Cultural identity-oriented design and responsible transformation of heritage	Culturally responsive design, visual memory and place-based innovation
6. Digital-innovative and STEAM-oriented	Digital modelling, CAD, 3D printing, UX/UI, AI tools, STEAM projects and digital fabrication	Digital prototyping, human-centred design and interdisciplinary innovation	Digital project capability, iterative prototyping and future-oriented design literacy

Stage 1: Traditional Craft-Based Education

The first stage is traditional craft-based education. Its historical basis lies in folk crafts, family workshops, guild traditions, village craft practices, decorative and applied arts, embroidery, weaving, ceramics, woodwork, metalwork and ornament. Learning was mainly practical, embodied and intergenerational. The learner observed, repeated, improved and gradually internalised the material and symbolic rules of a craft tradition (Kara-Vasylieva, 2008; Yakoviev, 2012).

Pedagogically, this stage contributed manual intelligence, sensitivity to material, patience, accuracy, rhythm, proportion and symbolic literacy. The product was not merely an object; it carried cultural meaning. Ornament, colour, pattern and material were connected with ritual, local identity and the social life of the community. This stage therefore formed an early type of design thinking, although it did not use the modern term: learners solved practical problems of making while preserving symbolic and aesthetic continuity.

For contemporary Design and Technology Education, this stage is important because it reminds educators that making is not only technical execution. Making is also cultural interpretation. A learner who studies traditional crafts can understand how form, function, material and meaning are integrated. This is highly relevant for sustainable design, place-based education and culturally responsive pedagogy.

Stage 2: Art-Industrial Education

The second stage is art-industrial education. It reflects the transition from craft practice to institutionalised training in drawing, composition, modelling, material processing and production. In the wider European context, this stage was connected with nineteenth-century debates about applied art, industrial production, national style and the education of artisans and designers. Semper's practical aesthetics and the European art-industrial school tradition are important reference points for understanding this shift.

In Ukraine, art-industrial education linked traditional decorative culture with the needs of modern production. Drawing schools, craft schools, art-industrial institutions and workshops helped learners acquire systematic knowledge of form, ornament, technical drawing, materials and manufacturing processes. The educational logic moved from imitation within a family or community tradition to a more formal curriculum that combined artistic and technical knowledge.

The pedagogical contribution of this stage is material-production literacy. Learners began to understand the relationship between drawing and making, between ornament and structure, between aesthetic intention and technological possibility. This stage prepared the ground for modern design education because it treated the object as a result of both artistic conception and production logic.

Stage 3: Avant-Garde Constructive-Modernist Education

The third stage is avant-garde constructive-modernist education. In the 1920s and 1930s, Ukrainian and broader Eastern European avant-garde movements experimented with new visual languages, construction, typography, poster art, scenography, industrial forms and social

communication. Education during this stage was shaped by experiment, abstraction, construction and the search for new relationships between art, technology and everyday life.

The avant-garde stage contributed an experimental logic to Ukrainian design education. Learners and artists were encouraged to question inherited forms, analyse structure, work with geometric composition, explore visual communication and connect design with social transformation. This stage is important because it anticipated many features of contemporary design thinking: reframing problems, experimenting with alternatives, using visual models, collaborating across disciplines and treating design as a tool for changing human experience.

For Design and Technology Education, the avant-garde constructive-modernist stage demonstrates that creativity is not merely a form of individual self-expression. It can also be constructive, analytical and communicative, involving the capacity to reframe problems, experiment with visual structures, communicate socially significant meanings and transform ideas into project outcomes. In this sense, avant-garde pedagogy anticipates the contemporary notion of creative confidence, understood by Kelley and Kelley (2013) as a person's confidence in their capacity to act creatively, overcome fear of failure and bring new ideas into practice.

Within the avant-garde constructive-modernist stage, the idea of form as an autonomous bearer of meaning is especially significant. Malevich's Suprematism, and particularly Black Square, shifted the emphasis from the representation of the object world to abstract geometric form, colour and compositional tension (Malevich, 2003; Tate, n.d.). For Design and Technology Education, this is important because form can be considered not only as the external shell of an object but also as a "form-message": a concentrated visual statement capable of communicating an idea, position or cultural code.

Stage 4: Technical-Aesthetic and Industrial Design Education

The fourth stage is technical-aesthetic and industrial design education. During the Soviet industrial period, Ukrainian design-related education became closely connected with technical aesthetics, industrial production, standardisation, ergonomics, functionality and the design of consumer and industrial products. The terminology and institutional context differed from Western design education, but the pedagogical content included many design-relevant elements: technical drawing, construction, functional analysis, materials, production processes and ergonomic reasoning.

The technical-aesthetic stage enriched Ukrainian design and technology education with ergonomic design reasoning, understood as the application of human factors/ergonomics principles to the design of products, systems and environments that optimise human well-being, usability and overall system performance (Grandjean, 1980; International Ergonomics Association, 2000). Within this stage, learners were expected to consider efficiency, manufacturability, standardisation, usability and the relationship between object and user, which corresponds to the ergonomic orientation of design as the adaptation of products, systems and environments to human needs and capabilities (Apisheva & Chukavina, 2006; International Ergonomics Association, 2000).

Although the ideological and administrative conditions of the Soviet period restricted individual creativity, this stage nevertheless developed important components of design and technology

capability, including functional analysis, ergonomic reasoning, awareness of production constraints and evaluation of the quality of the designed environment.

Its relevance for contemporary education lies in the discipline of function. Design education cannot be reduced to cultural expression or digital visualisation. It must also include constraints, systems, production, safety, durability, ergonomics and evaluation. The technical-aesthetic stage therefore provides the engineering and industrial layer of the Ukrainian design education trajectory.

Stage 5: Ethnodesign and National-Cultural Renewal

The fifth stage is ethnodesign and national-cultural renewal. After Ukrainian independence, cultural heritage, national identity, regional traditions and ethnocultural symbolism gained renewed educational significance. Ethnodesign emerged as a way to reinterpret traditional motifs, materials and cultural codes in contemporary design practice. This stage does not simply return to the past; it transforms heritage into a resource for modern creative education.

Pedagogically, ethnodesign contributes cultural identity-oriented design. Learners analyse traditional ornaments, craft technologies, local materials and symbolic systems, but they also adapt them for contemporary communication, fashion, interior design, product design, graphic design and digital media. The educational goal is not copying heritage but interpreting it responsibly. This develops visual literacy, cultural empathy, national awareness and the capacity to create design solutions rooted in local traditions of form and decoration.

In the Ukrainian context, the notion of creative confidence may be extended through design education oriented towards ethnodesign, nature-responsive form-making and ecological responsibility. The creative confidence of design learners is expressed not only in their readiness to experiment, but also in their ability to work with natural materials, traditional techniques, local cultural codes and ethnocultural memory. In this sense, design creativity emerges as a combination of innovation, tactile experience, respect for material, cultural continuity and responsible engagement with the natural environment.

In ethnodesign, creative confidence may also be evident in learners with developed intrapersonal intelligence, which Gardner (1983) associates with self-knowledge, awareness of personal motives, values and internal states. For such pupils and students, the semantic density of form is no less important than the choice of material or technique. They tend towards the creation of “forms-codes”, in which colour, sign, ornament, silhouette or compositional structure functions as a concentrated message. In this context, ethnodesign becomes a space where personal reflection is connected with ethnocultural memory and the designed product acquires the meaning of a visual statement about identity, tradition and a value-oriented attitude towards the world.

This stage has particular value for the international discourse of Design and Technology Education because many curriculum systems are now seeking culturally responsive, sustainable and locally meaningful approaches. Ethnodesign shows how national heritage can become a source of innovation rather than a conservative limitation. It also helps learners see that design is always culturally situated. One historical-cultural resource for contemporary ethnodesign is Ukrainian Baroque.

In contemporary ethnodesign, selected features of Ukrainian Baroque may be reinterpreted (Brovchenko & Rudenchenko, 2023; Makarov, 1994). Ukrainian Baroque, also known as Cossack Baroque, developed during the Hetmanate period as an original stylistic synthesis of European Baroque influences and local Ukrainian traditions, including church architecture, folk ornamentation and decorative-applied arts (Chyzhevsky & Sichynsky, 1984; Kostiuk & Fedoruk, 1991). Compared with Western European Baroque, Ukrainian Baroque was more constructivist, more restrained in ornamentation and simpler in form (Chyzhevsky & Sichynsky, 1984). In a broader international historical context, Ukrainian Baroque may be interpreted as one expression of Ukraine's cultural distinctiveness within Europe, shaped at the intersection of East European, Cossack-Hetmanate and Western European influences (Plokyh, 2015; Wilson, 2015).

Stage 6: Digital-Innovative and STEAM-Oriented Education

The sixth stage is contemporary digital-innovative and STEAM-oriented education. It includes digital modelling, computer-aided design, 3D printing, user experience design, interface design, multimedia communication, robotics, artificial intelligence tools, virtual and augmented reality, digital fabrication and interdisciplinary project work. In school and university contexts, this stage is closely linked with STEAM education and the development of twenty-first-century form-making capabilities.

The pedagogical contribution of this stage is digital project capability. Learners identify a problem, research user needs, generate concepts, model solutions, create digital or material prototypes, test and iterate. Digital tools expand the range of possible products and learning environments, but they do not replace historical and cultural knowledge. The strongest form of digital design education is not a narrow software training course; it is an integration of cultural literacy, material knowledge, technical reasoning and digital creativity.

In the Ukrainian context, the digital-innovative stage has not only a technological but also a civic and reconstruction-oriented dimension. Design and technology education can support sustainable reconstruction, inclusive environments, educational innovation, digital entrepreneurship and the development of creative industries. In the near future, the development of Ukrainian design and technology education will depend on the ability to connect digital transformation with historical memory and national cultural resources.

This tendency is already visible in the practices of contemporary Ukrainian designers who present national cultural codes on international design platforms (MAKHNO Studio, 2019; Maison&Objet, n.d.). Participation in events such as Maison&Objet and Paris Design Week demonstrates how craft traditions, ceramics, ornamentality and natural materials can be reinterpreted through contemporary product, interior and digital design. In this sense, contemporary Ukrainian design may be understood as moving from Ukrainian Baroque and ethnodesign traditions towards futuristic minimalism, digital modelling and new forms of cultural representation.

Cross-Stage Synthesis: What the Model Explains

The six-stage model explains Ukrainian design and technology education as a layered trajectory rather than a linear replacement of old practices by new ones. Each stage adds a pedagogical layer that remains relevant in contemporary education. The traditional craft-based stage

contributes embodied material knowledge and symbolic literacy. The art-industrial stage contributes systematic drawing, material and production literacy. The avant-garde stage contributes experimental visual communication and problem reframing. The technical-aesthetic stage contributes functionality, ergonomics and industrial constraints. The ethnodesign stage contributes cultural identity and heritage-based innovation. The digital-innovative stage contributes modelling, prototyping, user experience and STEAM integration.

This synthesis is important because many contemporary curricula risk separating digital innovation from cultural memory or treating heritage as a decorative supplement. The model suggests a different view: heritage, material thinking, industrial logic and digital design are not separate domains. They are successive and interacting layers of design capability. A learner who understands this continuity can move more meaningfully from a traditional ornament to a digital pattern, from a craft technique to a sustainable material solution, or from historical visual culture to contemporary interface design.

The model also clarifies the concept of project culture. Project culture is not simply the ability to complete a school project. It is a functional culture: an integrated capacity to notice a problem, understand context, work with materials and technologies, generate a form, communicate meaning, evaluate consequences and improve a solution. In the Ukrainian trajectory, functional project culture has been formed through different historical media: craft products, art-industrial exercises, avant-garde compositions, industrial objects, ethnodesign projects and digital prototypes.

Another important implication is the distinction between professional design education and general design and technology education. Professional design education prepares specialists for design industries. General Design and Technology Education develops broader design capability among learners. The six-stage model can support both, but its greatest value for schools lies in showing how historical material can enrich general design learning. A curriculum can use craft traditions, industrial design, ethnodesign and digital tools as interconnected resources for developing learners' creativity, technological literacy and cultural responsibility.

Discussion: Implications for International and Comparative Research

The Ukrainian six-stage model has implications beyond the national context. Many countries have their own historical trajectories from craft to industrial education, from technical drawing to design technology, from national applied arts to digital fabrication. However, these trajectories are rarely compared through a common framework. The model proposed in this article can be used as a comparative lens. Researchers may ask: What was the craft-based foundation of design education in a given country? How did art-industrial institutions formalise design-related learning? How did modernist or avant-garde movements influence design pedagogy? How did industrialisation shape technical and ergonomic education? How has cultural heritage been reinterpreted in design education? How is digital transformation changing the field?

Such questions allow comparative education to move beyond policy description. Instead of comparing only current curricula, researchers can compare historical-pedagogical layers. This is important because contemporary curriculum reforms often fail when they ignore inherited educational cultures. A digital fabrication laboratory, for example, may function differently in a

system with a strong craft tradition than in a system where craft has been marginalised. A STEAM curriculum may become more meaningful if it connects engineering and digital design with local cultural knowledge.

The model also contributes to debates about decolonising and pluralising design education. International design education has often been narrated through a limited set of Western canonical references. Bauhaus, Ulm, Scandinavian design and Anglo-American design thinking are important, but they do not exhaust the global history of design pedagogy. The Ukrainian case adds a perspective in which folk art, national-cultural survival, avant-garde experimentation, technical aesthetics and ethnodesign all play significant roles. This helps widen the international conversation about what counts as design knowledge.

At the same time, the model should not be used to romanticise national heritage. Ethnodesign becomes educationally powerful only when it involves critical interpretation, contemporary relevance and ethical use of cultural symbols. Teachers must avoid superficial decoration or stereotype. Learners should be encouraged to research sources, understand meanings, respect regional differences and transform motifs through responsible design reasoning.

For teacher education, the model suggests that future teachers of design and technology need both historical-cultural knowledge and practical digital skills. They should be able to teach learners how to draw, model, prototype and evaluate, but also how to understand the cultural biography of forms, materials and symbols. This is a demanding but productive vision of teacher professionalism.

Curriculum Implications

The six-stage model can inform curriculum design at several levels. At the primary level, learners can explore sensory and material experience through simple craft-based tasks, observation of natural forms, pattern-making, construction and storytelling. At the lower secondary level, pupils can connect material work with design problems, prototypes, simple mechanisms, visual communication and local cultural motifs. At the upper secondary level, learners can conduct design research, compare historical and contemporary solutions, develop digital prototypes and address social or environmental problems through project work.

In teacher education, the model can serve as a structure for a course on the history and pedagogy of Design and Technology Education. Each stage can become a module: craft and material culture; art-industrial education and drawing; avant-garde and visual communication; technical aesthetics and ergonomics; ethnodesign and identity; digital design, STEAM and future-oriented innovation. Such a course would avoid treating history as background information. Instead, history would become a resource for pedagogical design.

The model also supports assessment. Learners' projects can be evaluated not only by technical accuracy or aesthetic appearance, but by the integration of several dimensions: cultural research, functional reasoning, material appropriateness, creative transformation, digital modelling, user testing and reflection. This corresponds to the complex nature of design and technology capability.

Finally, the model can guide the development of learning materials. Textbooks, workbooks and digital resources can present Ukrainian design heritage not as an isolated historical section but

as a sequence of design challenges: How did traditional craftsmen solve problems of material and meaning? How did art-industrial schools connect drawing and production? How did avant-garde designers communicate new social ideas? How did technical aesthetics address usability? How can ethnodesign renew heritage? How can digital tools transform these resources into contemporary projects?

Limitations and Future Research

The study has several limitations. First, it proposes a conceptual model rather than an empirical evaluation of classroom outcomes. Future research should test how the model works in curriculum design, teacher training and student projects. Second, the article provides a national-level interpretation and cannot fully represent all regional differences in Ukrainian craft, art-industrial and design education. Third, the boundaries between stages are analytical rather than absolute; several stages overlap historically and pedagogically.

Future research may develop the model in three directions. The first direction is empirical: classroom studies could examine how learners respond to projects that connect ethnodesign and digital modelling. The second direction is comparative: researchers could use the model to compare Ukraine with Poland, the Baltic states, the United Kingdom, Finland, Japan or other countries with strong craft and technology education traditions. The third direction is curriculum development: the model could inform programmes for continuous design and technology education from primary school to specialised secondary and higher education.

The model may also be expanded to address sustainable development, reconstruction, inclusive design and creative industries. Ukraine's current educational and social context requires design and technology education that can support resilience, cultural continuity and innovation. Historical understanding can strengthen this task by giving learners a sense that design is not only a future-oriented activity but also a form of responsible continuity.

Conclusion

This article has proposed a six-stage historical-pedagogical model of Design and Technology Education development in Ukraine. The model traces the movement from craft traditions and folk-art practices to art-industrial education, avant-garde constructive-modernist experimentation, technical aesthetics and industrial design, ethnodesign and national-cultural renewal, and contemporary digital-innovative STEAM-oriented education.

The central conclusion is that Ukrainian design and technology education should be understood as a layered historical trajectory. Contemporary digital design does not cancel earlier forms of learning; it can productively integrate them. Craft traditions provide material and symbolic intelligence. Art-industrial education provides systematic links between drawing, production and form. The avant-garde provides experimental visual thinking. Technical aesthetics provides functional and ergonomic reasoning. Ethnodesign provides cultural identity and heritage-based innovation. Digital and STEAM education provides modelling, prototyping and interdisciplinary future-oriented capability.

For international research, the model offers a comparative framework. It enables scholars to examine how national systems of Design and Technology Education emerge from specific historical configurations of craft, industry, art, technology, culture and digital transformation.

For curriculum development, it offers a way to connect heritage and innovation, local identity and global design literacy, practical making and digital creativity. The Ukrainian experience therefore has significance not only as a national case, but as a contribution to broader debates about culturally grounded, historically aware and future-oriented Design and Technology Education.

The Model as a Pedagogical Framework for Design Capability

The six-stage model can be read not only as a historical periodisation, but also as a developmental framework for design capability. Each stage corresponds to a particular dimension of capability that can be intentionally cultivated in learners. The craft-based layer develops sensory attention, hand-eye coordination, patience, care and respect for materials. The art-industrial layer develops the ability to translate an idea into a drawing, a pattern, a construction or a manufacturable form. The avant-garde layer develops visual experimentation, abstraction and the courage to question established conventions. The technical-aesthetic layer develops an understanding of constraints, ergonomics, standards, production and usability. The ethnodesign layer develops cultural responsibility and interpretive sensitivity. The digital-innovative layer develops modelling, iteration, systems thinking and communication through contemporary media.

These dimensions correspond closely to the current aims of Design and Technology Education, but the model gives them historical depth. For example, user-centred design can be taught not only through contemporary UX methods but also through historical analysis of how objects served community needs. Sustainability can be taught not only through global environmental frameworks but also through craft traditions that valued repair, resourcefulness, local materials and durable forms. Digital modelling can be taught not only as a technical skill but also as a continuation of older practices of drawing, pattern construction and prototyping.

The model therefore supports a spiral curriculum. Learners can return to the same design problem at different levels of complexity. A younger learner may study a traditional pattern and create a paper or textile composition. An older learner may analyse the same pattern as a system of symmetry, cultural meaning and visual communication. A senior learner may transform it into a parametric digital model, an interface pattern, a fashion concept or a sustainable product. In this way, historical material becomes a living design resource rather than a museum fragment.

The framework also helps to balance creativity and discipline. Some versions of design education overemphasise free creativity and neglect technical constraints. Other versions overemphasise technical execution and neglect imagination, user experience and cultural meaning. The Ukrainian six-stage model shows that robust design capability requires the interaction of all these layers. A high-quality learning product should be meaningful, feasible, culturally aware, technically coherent and open to improvement.

Relevance for the United Kingdom Journal Context

For a British and international readership, the article is relevant because it places the Ukrainian case within the wider conversation on Design and Technology Education. In the United Kingdom, D&T has historically been associated with designing and making, materials, food, textiles, resistant materials, electronics, systems, evaluation and technological capability. The

Ukrainian trajectory differs institutionally, but it addresses comparable educational questions: how learners acquire practical intelligence, how drawing and modelling mediate design decisions, how technology and culture interact, and how design education prepares young people to participate in a changing world.

The comparison is productive because it does not require the Ukrainian system to mirror the British curriculum. Instead, it invites reciprocal interpretation. British D&T research can help Ukrainian scholars articulate design capability, iterative designing, user-centred evaluation and curriculum progression. Ukrainian historical-pedagogical analysis can help international scholars see how craft, ethnodesign, national visual culture and technical aesthetics may enrich design and technology learning. The value lies in dialogue rather than direct transfer.

The proposed model also responds to contemporary concerns about the place of D&T in school curricula. When design and technology is interpreted narrowly as a set of workshop techniques or digital tools, its educational significance may be underestimated. The Ukrainian model strengthens the argument that design and technology is a culturally, intellectually and socially significant field. It connects historical memory, material action, technological reasoning, creativity, user needs, digital transformation and civic responsibility.

This is particularly important in contexts affected by rapid technological change and social disruption. Design and technology education can help learners imagine and make better environments, products, services and systems. In Ukraine, this has additional significance because reconstruction, accessibility, sustainability, cultural resilience and digital innovation are not abstract topics. They are educational and social necessities.

Practical Examples of Curriculum Use

The model can be translated into concrete curriculum tasks. At the craft-based level, learners might investigate a local craft tradition, document materials and techniques, and produce a small object or visual pattern while explaining its cultural function. At the art-industrial level, they might convert a hand-made pattern into a technical drawing, develop a repeat unit, or plan the production of a simple object. At the avant-garde level, they might redesign a traditional visual element as a poster, pictogram or typographic composition. At the technical-aesthetic level, they might evaluate the ergonomics and function of a household object or school product. At the ethnodesign level, they might design a contemporary product that responsibly reinterprets heritage. At the digital level, they might create a CAD model, interactive prototype, animation, augmented reality visualisation or digital fabrication file.

Such tasks can be organised as short modules or as a long interdisciplinary project. For example, a project on a “sustainable learning object inspired by Ukrainian craft” could begin with research into craft traditions, continue with drawing and material experiments, include ergonomic and functional analysis, reinterpret ethnocultural motifs, and end with a digital prototype or 3D printed model. Assessment could include research quality, cultural interpretation, technical accuracy, prototype functionality, user testing and reflective evaluation.

The model is also useful for extracurricular and specialised education, including work with gifted learners, science and design clubs, STEAM laboratories and junior research academies. Learners can conduct small investigations: comparing historical and contemporary materials,

analysing the geometry of ornaments, studying the ergonomics of craft tools, or designing digital interfaces that present cultural heritage. In such contexts, design and technology education becomes a bridge between research, creativity and socially meaningful action.

Teacher guidance is essential. Learners should not be asked simply to “use national motifs”. They should be taught to investigate sources, identify regional specificity, understand the meaning of symbols, avoid cliché, and justify their design transformations. This aligns ethnodesign with critical and ethical design pedagogy rather than decorative nationalism.

Theoretical contribution

The theoretical contribution of the article is the articulation of historical-pedagogical continuity as a principle of Design and Technology Education. The model suggests that design capability is historically constituted. It is formed through traditions of making, drawing, constructing, communicating, standardising, interpreting and digitising. Contemporary design learning is therefore not only a response to future technologies but also an inheritance of multiple past forms of knowledge.

The model also contributes to the theory of project culture as functional culture. Project culture is presented as a historically layered competence that includes material, visual, technical, cultural and digital dimensions. This distinguishes it from narrower concepts of creativity or technical skill. A learner with project culture can connect a problem with a context, a context with a form, a form with a material, a material with a technology, a technology with a user, and a user with a broader cultural and ethical meaning.

Finally, the model contributes to comparative education by offering a structure that can be adapted to other national cases. Researchers may identify analogous stages in their own contexts or revise the stages according to local histories. The model is not intended as a universal chronology. It is a comparative instrument that makes national specificity visible while enabling international dialogue.

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