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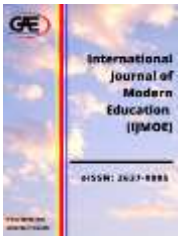

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TRANSFORMATION OF CARVING LEARNING: A STUDY ON THE UTILIZATION OF DIGITAL MEDIA AS A SOURCE OF ADAPTIVE LEARNING FOR THE YOUNG GENERATION OF CARVERS IN JEPARA

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Abstract:

The Jepara carved furniture industry in Indonesia has historically relied on the transmission of cultural knowledge between generations through *Nyantrik*, a traditional apprenticeship system. However, shifting socio-cultural contexts and the increasing accessibility of digital technologies have changed the way young generations acquire and develop carving skills. This study examines the transformation of carving learning by analysing the integration of digital media as an adaptive learning resource. Using a sequential exploration mixed method design, this study investigated the attitudes of young artisans and assessed their readiness to adopt digital tools. The research findings show how technology exposure is mediated by adaptive capacity to produce a hybrid of traditional innovation and continuity. Quantitative analysis using One-Way ANOVA revealed significant differences in perceptions of design evolution among sculptors, entrepreneurs, and designers [$F(2, 154) = 15.42$, $p < 0.001$], but identified an integrated commitment to adaptive strategies. The study concluded that effective use of digital media, when combined with guidance from senior carvers, is essential to sustain Jepara's carving industry. This research contributes a theoretical framework for heritage preservation in the digital age, offering a foundation for integrating modern pedagogy with local wisdom.

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Keyword:

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Introduction

Wood carving in Jepara, Indonesia, has long been recognized as a cultural heritage that has existed for centuries, and it has become an essential part of the identity and history of the local community. However, over time, this art form has faced significant challenges, particularly because it struggles to attract younger generations to continue the craft. Moreover, the rapid development of digital technology has opened new opportunities in education, including in the field of wood carving. Nevertheless, the use of digital media as an adaptive learning resource for young carvers in Jepara has not yet been fully optimized. Therefore, this research is crucial to explore how digital media can serve as a solution to these challenges while supporting the sustainability of Jepara's wood carving tradition. The integration of digital technology into art education holds great potential to enhance young people's skills and interest in traditional art. In addition, the use of digital media in art learning is important to improve the effectiveness and efficiency of the learning process (Yingjun, 2021). Nevertheless, efforts to adopt technology in art education face major obstacles, such as limited resources, insufficient technological understanding, and inadequate training, which hinder its effectiveness (Artman-Meeker, 2014). Furthermore, the lack of proper infrastructure and training support has also become a significant barrier in implementing technology in art education (Osorio, 2024). Digital- based Jepara carving learning needs to be understood in the framework of tacit knowledge, situated learning, and cultural transmission, because carving skills are not only learned through formal instruction, but through body practice, social interaction, and a contextual apprenticeship system.

The principal challenge in sustaining Jepara's woodcarving tradition lies in the limited interest and insufficient skills among the younger generation. This condition is largely attributed to the absence of pedagogical approaches that correspond to their digital- oriented lifestyle, as they are generally more accustomed to digital media than to traditional learning methods. Similarly, the decline of formal craft training since the 1990s, particularly in the United Kingdom, has resulted in a shortage of skilled artisans and a significant reduction in production capacity (Li, 2024). Although Jepara furniture players have shown significant adaptability to cultural and market changes, the absence of a structured and integrated adaptive strategy has the potential to weaken the position of local products in the global market ecosystem. The cultural values embedded in woodcarving products are therefore at risk of being lost, which in turn may endanger the long-term sustainability of the industry.

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Furthermore, vocational education systems often fail to align with the practical demands of the craft industry, thereby limiting opportunities for the younger generation to participate in this sector (Dilarom, 2022). In addition, the absence of sufficient training in design thinking and business management continues to constitute a major barrier to achieving global competitiveness. The implementation of technology-based co-design programs and intergenerational training is thus critical as a strategic measure to preserve the aesthetic and philosophical essence of woodcarving, thereby countering the increasing dominance of generic mass-produced products (Shiwen, 2024).Finally, the enhancement of human capital through well-targeted skills development programs is essential, as it can foster innovation, strengthen competitiveness, and ensure the long-term sustainability of the Jepara woodcarving industry (Zhang, 2023).

Although digital media technology provides unlimited access to knowledge, its adoption by young carvers in Jepara to learn woodcarving skills remains largely unexplored. The key issue identified concerns how young artisans specifically integrate and utilize digital media (such as video tutorials and social media) as part of their self-directed learning strategies. This gap creates a dilemma regarding how the carving industry can preserve its authenticity. There is a risk that efforts to preserve carving traditions may be hindered or, conversely, that technology adoption may occur without clear direction, ultimately eroding the cultural identity and competitive advantage of the Jepara woodcarving industry.

To address this knowledge gap, this study holistically examines how the younger generation of carvers in Jepara integrates traditional learning with the use of digital media. The primary gap to be filled lies in the lack of empirical data on adaptive learning mechanisms that emerge from the interaction between these two sources of knowledge. To achieve this, the study employs a mixed-methods approach, combining in-depth interviews and participant observation to explore the subjective experiences of young artisans, as well as surveys to measure their usage patterns and perceptions of digital media. This approach is expected to provide a more comprehensive and balanced understanding of the phenomenon under investigation.

Theoretically, this research is expected to contribute to the development of informal learning theories and adaptive attitudes within the context of cultural heritage preservation and the regeneration of young carvers. It will also enrich the body of literature on how technical skills are transferred in the digital era, particularly within the handicraft sector. Practically, the findings of this study may provide a foundation for local governments, craft associations, and vocational education institutions in Jepara to design more relevant and effective and training programs that integrate digital tools without disregarding traditional values. In addition, this research seeks to examine the application of digital media in woodcarving education in Jepara as an adaptive learning resource for the younger generation of carvers. The integration of digital media into woodcarving education has the potential to increase young artisans' interest and skills, while simultaneously supporting the preservation of traditional woodcarving through more adaptive and contextually relevant learning methods. Thus, this study plays a crucial role in ensuring the sustainability and evolution of the Jepara woodcarving industry in the future.

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Literature Review

There are five points will be discussed in Literature review: (1) Adaptive Learning Concept, (2) The Role of Technology in Traditional Arts Education, (3) Challenges in the Preservation of Traditional Crafts, (4) Adaptive Learning and its Application in Crafts Education, and (5) Digital Transformation in Traditional Art Forms.

Adaptive Learning Concept

Adaptive learning theory emphasizes the adjustment of teaching strategies and resources according to the needs and abilities of individual learners. Within this context, digital technology functions as a tool that facilitates more flexible and interactive learning (Xia, 2024).The concept of digital learning media suggests that the integration of technology in education not only improves accessibility but also enriches the learning experience through a variety of interactive formats, such as videos, animations, and web-based applications (Z. Yang, & Don, C., 2024). Accordingly, the utilization of digital media can support the development of skills in Jepara woodcarving by tailoring instructional materials to meet the needs of younger generations who are increasingly exposed to technology. This approach is relevant to the Technology Acceptance Model (TAM) framework, which explains that the level of adoption of digital technology in learning, including in the context of carving and furniture, is greatly influenced by users' perception of its benefits and ease of use.

The Role of Technology in Traditional Arts Education

The process of digital design in art education promotes the development of autonomy and self-critical capacity among students. Furthermore, digital technologies have transformed higher education and the advancement of vocational training (González-Zamar, 2021). Addition, art education demonstrates that the use of digital media technologies can enhance learning skills, enabling students to engage in more independent and interactive learning. For instance, video tutorials improve the understanding of complex concepts due to their ability to visualize processes in detail (Gong, 2021). Similarly, in art education, the integration of digital media offers opportunities to visualize intricate artistic techniques in ways that are more accessible and comprehensible to younger generations (Valera, 2024). Online platforms and visual learning applications such as video tutorials and step- by-step illustrations have also been shown to increase students' interest in traditional art forms (Vlizos, 2024). Collectively, these insights highlight that digital technology holds significant potential to enrich the learning experience in art education. The use of digital technologies facilitates contemporary cultural transmission, allowing traditional Jepara carving knowledge to be passed on through media compatible with the digital habits of younger generations.

Challenges in the Preservation of Traditional Crafts

The importance of preserving traditional arts, such as woodcarving, lies in their sustainability as an integral part of local cultural identity (Zhao, 2025). However, significant challenges arise in maintaining the relevance of traditional arts amid rapid social and cultural changes, particularly for younger generations who are more attracted to technology (Antunes, 2022). Although various initiatives have been undertaken to digitize woodcarving, major obstacles remain due to the limited use of technologies that align with the unique characteristics of traditional art learning (Koteleva, 2021). To address these challenges, it is essential to

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introduce more adaptive and contextually relevant digital learning methods for the younger generation of carvers in Jepara.

Adaptive Learning and its Application in Crafts Education

Adaptive learning enables instructional materials to be tailored to the learner's level of ability, thereby enhancing the effectiveness of the learning process (Yina, 2024). In addition, adaptive learning supported by technology can provide personalized experiences that correspond to individual learning paces and styles. The use of AI-based learning systems to assess student abilities and deliver personalized feedback has been shown to improve both engagement and learning outcomes (Zhang, 2024). Within the context of woodcarving education, adaptive learning also helps address the challenge of diverse abilities among students who come from different backgrounds and experiences. Furthermore, online platforms that offer courses or video-based training provide young carvers in remote areas with access to learning opportunities without requiring them to attend traditional training centers. The transition to digital platforms represents a significant evolution in the "Nyantrik" apprenticeship tradition, ensuring that the tacit knowledge and mentorship central to Jepara carving are maintained, even as learning becomes increasingly distributed and mediated through technology.

Digital Transformation in Traditional Art Forms

Digital transformation in traditional arts has gained considerable attention in recent years, with a particular focus on the use of digital platforms to promote, document, and teach traditional art forms (Chen, 2024). Research indicates that by leveraging technologies such as social media, online videos, and interactive websites, traditional arts can be made accessible to wider and younger audiences (Vlizos, 2024). Although Jepara woodcarving has already been introduced on various digital platforms to showcase local works to the world and engage younger generations who are more exposed to digital culture, the implementation of these technologies remains uneven. On the one hand, digital technology has the potential to enrich the learning of arts and culture; on the other hand, its application within local art communities presents significant challenges. Moreover, the lack of effective technology integration in the education and training of young carvers continues to pose a major obstacle to ensuring the long-term sustainability of this craft.

Research Methods

This study employs a structured research methodology to ensure systematic investigation and analytical rigor. The research methods section outlines the research design, population and sample, research instruments, data collection procedures, and data analysis techniques used to address the research objectives.

Research Design

This study adopts sequential exploratory mixed-methods design, beginning with a qualitative phase followed by a quantitative phase. This design is particularly suitable for deeply exploring the adaptive strategies employed by actors in Jepara's carved furniture industry and subsequently validating these findings within a broader population. The qualitative phase is conducted first to capture detailed insights into the experiences, perceptions, and cultural adaptation strategies of industry stakeholders in responding to shifts in cultural values.

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The exploratory findings serve as the foundation for developing quantitative instruments, which are subsequently used to measure the prevalence and generalizability of the observed patterns. Data integration occurs during the interpretation stage, where qualitative findings are triangulated and complemented with quantitative data, thereby providing a more robust and comprehensive understanding of the phenomenon under investigation.

Population and Sample

The population of this study consisted of eight woodcarvers and five younger respondents who participated in in-depth interviews. In the quantitative phase, a stratified random sampling technique was employed based on occupational roles such as artisans, designers, and entrepreneurs. Eligible respondents included individuals registered with local industry associations or professional design networks. A total sample of 157 respondents was selected to represent industry-wide trends in adaptive behavior and cultural orientation. Five young respondents were interviewed extensively to explore their experiences with digital technology-based woodcarving learning.

Research Instruments

The instruments used in this study consisted of two types: quantitative instruments and qualitative instruments. For the quantitative data, a questionnaire was employed to gather responses from young participants regarding their use of digital media, its influence on woodcarving skills, and their engagement in the learning process. The questionnaire utilized a Likert scale 1 - 5 to measure students' perceptions. For the qualitative data, an interview guide was designed to explore the perspectives and experiences of students in using digital media as a learning tool. The validity of these instruments was assessed through expert review, while their reliability was tested using Cronbach's alpha coefficient.

The research instruments consisted of a structured questionnaire for quantitative data, designed to measure the use of digital media and perceptions of its benefits. For the qualitative data, an interview guide was employed to explore the interrelations among stakeholders, their adaptive strategies, and policy implications. All instruments were carefully developed to ensure alignment with the overall research objectives.

Data Collection Procedure

The data collection procedure began with administrative preparation, including obtaining permission from furniture industry companies and informing the research participants. Quantitative data was collected from five students undertaking industrial internships, who completed the questionnaires directly at their workplaces. In addition, qualitative data were gathered through in-depth, face-to-face interviews with another five students. All collected data was processed with strict attention to confidentiality and the integrity of the information.

Data Analysis Techniques

Data analysis was carried out using an exploratory sequential approach to enable comprehensive integration of findings. At the qualitative stage, thematic analysis was applied to identify the main patterns and themes regarding the perception of digital media among young carvers and industry stakeholders. These qualitative findings then form the basis for the

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quantitative stage, which uses descriptive and inferential statistics including correlation tests and One-Way ANOVA to assess the frequency, trends, and differences between professional groups. Furthermore, these two data sets are combined at the interpretation stage, so that the patterns of the survey can be reinforced and enriched with qualitative narratives, resulting in a more comprehensive understanding of digital transformation in the wood carving learning ecosystem.

Results and Discussion

This section presents the findings from both the quantitative and qualitative data, which collectively address the research objectives concerning the role of technology and digital media in woodcarving skill learning. The qualitative results are presented first to provide an overview of the opportunities and challenges in utilizing technology for woodcarving education among younger generations, followed by the quantitative findings, which enrich the interpretation with deeper narratives about the interrelations within professional communities and among stakeholders.

Qualitative Results

Qualitative analysis was obtained Based on interview data, and in-depth qualitative questionnaires identified five main themes related to the transformation of carving learning:

Digital Technology Integration: Opportunities and Challenge

Digital technology creates both opportunities and challenges for the regeneration of traditional carvers. While it poses challenges for the regeneration of traditional carvers, it simultaneously offers significant opportunities to expand market reach. Adaptive practitioners have begun leveraging social media and e-commerce platforms to independently promote their products to a global consumer audience. In addition, they are increasingly utilizing digital design tools such as computer-aided design (CAD) and 3D rendering to showcase their work to potential clients. This approach not only strengthens product identity but also facilitates designer collaboration and enhances the perceived value of the craft. Although the cost of technology remains a barrier for some, digital tools are progressively recognized as a strategic bridge to broader markets.

Table 1: Respondents' Demographic Profile and Digital Technology Perception

Respondent Average	Respondent Profile		
	Age	Education	Status
	1.8	3	1

Description and criteria:
Age: 1= < 18 year; 2 = 18-25 year; 3 = 26-35 year; 4 = >35- year
Education: 1= Primary school; 2= Vocation School; 3= High School 4= College
Status: 1 = Internship; 2= Junior Caver; 3= Professional Carver; 4= Inactive

This condition highlights the strong potential for mastering digital technology in carving education, given that the younger generation is generally more adaptive to technological developments. However, they also require structured mentoring and training to effectively integrate digital competencies with traditional carving skills.

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Utilization of Digital Technology in Carving Learning

The findings showed that respondents' average use of digital technology was categorized as rare (score 2.6), with participation in training sessions averaging only once or twice (score 2.4). In contrast, their perception of the effectiveness of digital technology in carving learning was rated very high (score 1.2). This contrast indicates a clear gap betw2en the limited frequency of use and training participation and the strongly positive perception of digital technology's effectiveness.

Table 2: Utilization Of Digital Devices and Perception of Training Effectiveness

Respondent Average	Utilization of Technology		
	Use of Digital Device	Participating in Training	Effectiveness of Digital
	2,6	2,4	1,2

Description and criteria:
Use of Digital Devices 1= very often; 2 = quite often; 3 = infrequently; 4= never. Participated in training 1= often; 2 = ever one/two; 3 = never ;4 = not interested. The Effectiveness of Digital 1= Highly effective; 2=Quite effective;3= less effective ;4 = ineffective.

Therefore, despite the limited use of digital devices and low participation in training, respondents recognize the significant potential of digital technology to improve carving education. Consequently, strategies to broaden access and strengthen training opportunities are essential to fully realize these benefits.

Perception of Digital Technology in Carving Learning

The results of the analysis showed that the average respondent involved in the study on the perception of digital technology in carving learning was in the age category of 18–25 years old (average score of 1.8), with the level of education generally in a vocational or vocational school (score 3), as well as status as an intern (score 1). This profile illustrates that most of the respondents are young people with a secondary education background who are still in the early stages of involvement in the carving industry.

Table 3: Digital Learning Readiness and Identified Implementation Barriers

Respondent Average	Digital Learning Readiness		
	Desire to Develop?	The main Obstacle?	Help the value of Tradition?
	1.6	2.4	1.6

Description and criteria:
Desire to develop? 1=Very large;2=Quite large;3= a little;4=none.
The main obstacle? 1=Limited access; 2= less devices; 3= unused; 4=content is not appropriate.
Help the value of tradition? 1=very possible; 2=Yes, if customized; 3= Not sure;4= Tradition can be disappeared.

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The results indicate that while respondents are highly motivated to adopt digital technology, its implementation remains hindered by inadequate facilities. At the same time, their favorable perception of technology's potential in sustaining tradition underscores the opportunity to develop a carving learning model that merges innovation with the preservation of local cultural values.

Technology Learning in the Future

The findings on the future expectation aspect showed that respondents preferred an online course-based learning model (score 3.4) over other options such as mobile applications, video tutorials, virtual reality, or discussion platforms. Meanwhile, learning strategies are considered very important (score 1) in supporting the effectiveness of the digital-based carving learning process.

Table 4: Future Learning Model Preferences and Strategic Importance

Respondent Average	Future Hope	
	Learning Model	Learning Strategies
	3.4	1

Description and criteria:
Learning Model 1=Learning mobile app; 2=Tutorial Video; 3=Virtual Reality ;4= Online Course; 5=Discussion Platform.
Learning Strategies 1=very important; 2= important; 3= Not very important; 4= It doesn't matter at all.

These findings reflect respondents' preference for online learning formats that are both flexible and accessible, while also underscoring the need for robust learning strategies to ensure the successful integration of digital technologies into carving skills training.

Quantitative Findings

Quantitative analysis was conducted to measure the perception, responses, and relationships among human actors regarding variables influencing the evolution of carved furniture products in Jepara's industry. The quantitative findings indicate a significant difference in perception among three professional groups: carvers, furniture entrepreneurs, and furniture designers.

These differences were observed for two out of three main variables studied: the evolution of carved furniture design (X1) and the impact of changes in carved furniture design trends (X2). However, for the variable concerning the strategies and adaptation of carved furniture industry players (X3), no significant differences were found among the professional groups.
The One-Way ANOVA results revealed significant differences in perceptions regarding the evolution of carved furniture design (X1) [$F(2, 154) = 15.42$, $p < 0.001$] and the impact of design trends (X2) [$F(2, 154) = 8.76$, $p < 0.01$].

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Table 5: Descriptive Statistics of Three Main Variables by Occupational Group

Variable	Carver (n = 95) Mean ± SD	Businessman (n = 32) Mean ± SD	Designer (n = 32) Mean ± SD
(X1) The Evolution of Furniture Design	32.32 ± 3.099	35.78 ± 2.549	34.60 ± 2.660
(X2) The Impact of Design Trend Changes	33.22 ± 3,523	31.38 ± 3,687	33.10 ± 3.687
(X3) Industry Strategy and Adaptation	28.41 ± 2.739	28.44 ± 3.182	29.57 ± 3,401

Differences in Perceptions of Design Evolution

There's a significant difference among the three professional groups carvers, furniture entrepreneurs, and designers regarding the evolution of carved furniture design trends. Entrepreneurs (average: 35.78) and designers (average: 34.60) show a higher perception of this evolution compared to carvers (average: 32.32). This indicates that the entrepreneur and designer groups are more adaptive and responsive to changing trends, whereas the carver group tends to be more conservative and adheres more strongly to traditional values.

Differences in Perceptions of the Impact of Design Changes

There is a significant difference between entrepreneurs and carvers in how they perceive the impact of changes in carved furniture design. Specifically**,** entrepreneurs report experiencing a greater impact reflected in higher average scores particularly in relation to market dynamics and global trends. In contrast**,** carvers perceive a lower level of impact, as their work remains largely grounded in traditional techniques and practices. Meanwhile**,** designers fall in between these two groups; they report a relatively high perception of impact, although their evaluations are not statistically different from those of either entrepreneurs or carvers.

Similarities in Strategy and Adaption

No significant differences were found among the occupational groups in terms of their strategies and adaptation variables. Specifically**,** the three groups' carvers, entrepreneurs, and designers demonstrated similar approaches in responding to changes within the industry. This finding suggests a shared awareness of the importance of adaptation, regardless of their differing backgrounds and professional roles.

Social and Structural Implications

These differences in perception reflect the structural positions and professional orientations of each group. Specifically**,** designers and entrepreneurs tend to focus more on innovation and market responsiveness, whereas carvers remain more closely tied to traditional craftsmanship. Nevertheless**,** the observed similarity in adaptation strategies highlights the potential for cross- professional collaboration in addressing the evolving challenges faced by the Jepara carved furniture industry.

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Integration of Quantitative and Qualitative Results

The integration of qualitative and quantitative findings reveals a high degree of convergence regarding the digital transformation of carving learning in Jepara. While the quantitative survey data (Table 4) confirms significant differences in design perception among stakeholders with designers and entrepreneurs holding more progressive views [$F(2, 154) = 15.42, p < 0.001$] the qualitative narratives provide the necessary context for these statistical variations. The interviews suggest that these differences are rooted in varying levels of technological exposure and market interaction. However, despite these perceptual gaps, both datasets point toward a unified commitment to adopting digital media as a strategic bridge for cultural sustainability.

To synthesize these complex interactions, a conceptual model is presented in Figure 1 This model illustrates the transition from technological input to sustainable cultural output, mediated by the community's adaptive capacity.

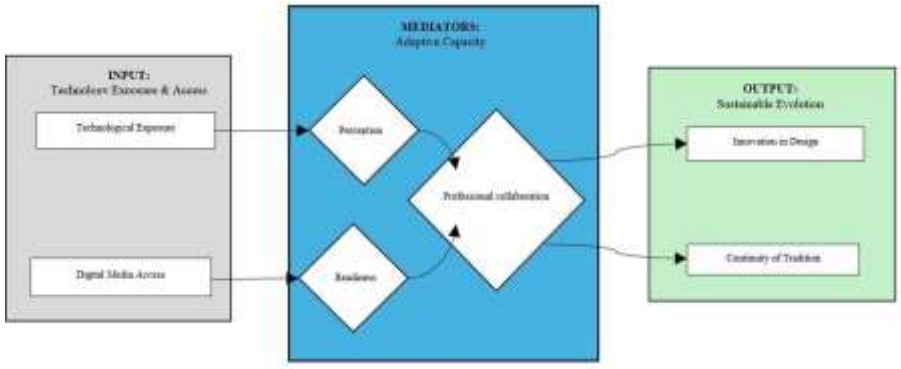

Figure 1: Integration Of Digital Learning Adoption, Cultural Preservation, and Professional Collaboration in Jepara's Carving Ecosystem.
Source: Author, 2025.

The conceptual model presented in Figure 1 synthesizes the transformation of carving learning by mapping the dynamic interactions between technological drivers and traditional values. The model is structured into three main phases:

1. Inputs (Technology Exposure & Access): This phase represents an external catalyst for change. Technology Exposure refers to the daily interactions of young people with digital platforms (e.g., social media and video tutorials), while Digital Media Access highlights the availability of internet hardware and infrastructure. This input serves as the basis for self-paced learning outside of the traditional "*Nyantrik"* apprenticeship system.

2. Mediators (Adaptive Capacity): The transition from input to output is governed by three important mediators.

   i. Perception acts as a cognitive filter by which the engraver evaluates digital tools as "highly effective" (as shown in Table 2).
   ii. Readiness reflects the sculptor's motivation for self-development despite the limitations of physical devices (as shown in Table 3).
   iii. Professional Collaborations represent a bridge between actors (sculptors,

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entrepreneurs, and designers). Arrows show that positive perception and readiness encourage more effective collaboration, allowing for the exchange of traditional mastery and modern design thinking.

3. Output (Sustainable Evolution): The results of this integrated ecosystem are twofold.
   i. Innovation in Design arises from the use of digital tools (CAD, 3D rendering) to meet the demands of the global market.
   ii. The continuity of tradition ensures that the symbolic and philosophical essence of Jepara carvings is preserved by adapting them into modern formats.

The two-way flow in the mediator shows that as collaboration grows stronger, it further increases people's perception and readiness, creating an independent adaptive learning cycle. This model shows that digital transformation does not replace tradition but rather provides a hybrid framework for its survival in the digital age.

Theoretical Reflection: TAM and Cultural Transmission

The findings of this study, represented in the conceptual model in Figure 1, present a solid theoretical foundation for digital transformation in traditional carving practices. This analysis integrates empirical evidence with Technology Acceptance Model (TAM) and Cultural Transmission theory, illustrating a shift towards a hybrid learning ecosystem that blends traditional practices with digital technologies.

First, the integration of digital media aligns closely with the core principles of the Technology Acceptance Model (TAM). High perceived usability of platforms such as YouTube and Instagram serves as a key driver for skill acquisition, offering flexible and self-directed learning pathways for young carvers (Dias, 2021; Pires, 2022). As illustrated in Figure 2, the craftsman's perception and readiness act as critical mediators. Although perceived ease of use is constrained by internet connectivity and device availability in remote areas, the strategic value of digital tools for market reach and design innovation remains paramount (Eskak, 2019; Guspian, 2025). Interactive features on Instagram, including likes, comments, and live sessions, provide rapid feedback that directly informs creative decision-making and technical problem-solving (Bishop, 2025; Kelly, 2023). Moreover, adaptive learning strategies combined with diverse didactic techniques prove more effective than single-method approaches, particularly when supported by intelligent and analytical learning environments (Hongchao, 2019; Rincon-Flores, 2024). Second, this study extends Cultural Transmission Theory by illustrating a shift from purely intergenerational apprenticeship to a decentralized, multi- pathway model. While digital technologies can capture intricate technical details and serve as high-precision visual resources (Eskak, 2019; Yanli, 2024), they cannot replicate the subtlety of the "Seni Pahat" or the tactile nuances of chiseling that require direct, hands- on mentorship. Consequently, knowledge transmission in Jepara now relies on the interplay between formal, informal, and digital platforms (Li, 2023; Muhajirin, 2024). As depicted in the "Professional Collaboration" component of Figure 2, artisans have become active agents within a socio-ecological production system rather than passive recipients. Intergenerational divergence highlights broader dynamics, with younger carvers prioritizing adaptation for sustainability while older artisans emphasize cultural preservation (Kofler, 2024; Öngel, 2024).

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However, the digitalization of traditional sectors also introduces systemic challenges that require careful consideration. Concerns persist regarding the potential dissemination of inaccurate information and the absence of direct mentorship in digital environments (Keane, 2022). Furthermore, as the adoption of digital design practices has yet to be institutionalized collectively, there is a risk that such innovations remain fragmented (Mutiara, 2024). Comparative evidence from Taiwan suggests that cultural heritage can be more effectively integrated into educational programs through a combination of technical training, artist mentorship, and oral transmission within a structured framework (Hung, 2021). Ultimately, fostering the integration of cultural values and local creativity necessitates programs that simultaneously promote design literacy and environmental awareness (Habara, 2022).

Figure 2: Two Young Students Are Operating A CNC Machine in A Small Furniture Workshop

Source: Author Document, 2025.

Finally, the shift toward a hybrid learning ecosystem safeguards the revitalization of cultural identities rather than their erosion. This process necessitates ongoing adaptation to industrial pressures while leveraging digital innovations to foster an inclusive creative economy (Indrayani, 2022; Judijanto, 2024). By anchoring technology adoption within community- based social capital, such as "*gotong royong*" and artisan loyalty, Jepara's carving industry can ensure that digital tools function as accelerators of creativity, while traditional values preserve authenticity (Gowlland, 2012; Wang, 2025; H. Yang, 2024).

Conclusion

In conclusion, this study shows that digital media has evolved from a peripheral tool to an important resource for the younger generation of sculptors in Jepara to facilitate independent learning and creative innovation. The transformation of carving learning is best characterized by the hybrid model synthesized in Figure 1, which illustrates how exposure to technology is successfully mediated by the engraver's positive perception and adaptive readiness. This model asserts that while digital platforms provide a "way" of technical mastery, the "essence"of the craft remains anchored in professional collaboration between traditional masters and young craftsmen.

Furthermore, the quantitative findings underscore that while professional groups differ in their perception of design evolution, they share a unified adaptive strategy toward technology adoption. The integration of digital tools does not signify the end of the "*Nyantrik"* tradition; rather, it represents its digital evolution enabling the preservation of cultural identity while simultaneously fostering global competitiveness. The effective use of digital media in adaptive learning strategies is an important factor in ensuring that cultural identities remain relevant. Ultimately, the sustainability of Jepara's carving industry depends on this strategic alignment

between innovation and tradition, ensuring that the craft remains both culturally significant and economically viable in the digital era.

Contribution

Theoretically, this study contributes to the discourse on cultural adaptation in design by highlighting how traditional industries strategically respond to shifting cultural values through creative innovation. This study expands our understanding of how heritage-based industries integrate modern aesthetics without losing their symbolic foundations. Practically, the research provides valuable insights for policymakers, cultural entrepreneurs, and design educators. It offers a model for integrating cultural preservation with the demands of contemporary design, while also suggesting actionable steps for vocational training, heritage certification, and designer–artisan collaboration. Furthermore, the findings support the development of educational policies that position cultural identity as a core component of sustainability within the creative industries.

Impact

Young generations show limited interest in pursuing a career in carving, largely due to economic pressures and the social stigma associated with manual skills. Practitioners emphasize the need to integrate carving education at the elementary school level to ensure long-term regeneration. In addition, they propose vocational training programs and certification schemes to enhance the prestige and economic prospects of the profession. Such adaptive strategies based on digital technology aim to revive appreciation for learning to carve, not merely as a craft but also as an identity and cultural heritage. Moreover, these strategies have the potential to bridge generational awareness and revitalize local cultural values through the effective use of technology.

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