



ENHANCING TEXTILE SCREEN PRINTING EDUCATION THROUGH MULTIMEDIA LEARNING APPROACHES

Scientific paper
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ABSTRACT: Over the past decades, education has undergone significant transformations driven by digitalization, globalization and rapid technological development. Advances in internet technologies, multimedia systems and digital learning platforms have reshaped the ways knowledge is delivered, acquired and shared. Digital tools have evolved from supportive resources into essential components of contemporary pedagogical models, enabling flexible, student-centered, and practice-oriented learning environments. Within this framework, multimedia learning has proven to be an effective approach for teaching complex technical subjects. Multimedia learning occurs when learners construct mental representations through the integration of verbal and visual information, leading to improved comprehension compared to text-based instruction alone.

This paper presents a multimedia-based approach to teaching textile screen printing technology. The presented case illustrates how multimedia-supported instruction can improve the teaching and learning of textile screen printing and highlights the potential for applying similar approaches in other practical and process-oriented areas of graphic and textile engineering education.

Keywords: Education, multimedia systems, digital learning textile, screen printing.

UNAPREĐENJE OBRAZOVANJA U OBLASTI SITO ŠTAMPE NA TEKSTIL PRIMENOM MULTIMEDIJALNIH PRISTUPA UČENJU

APSTRAKT: Tokom proteklih decenija obrazovanje je doživelo značajne transformacije pod uticajem digitalizacije, globalizacije i brzog tehnološkog razvoja. Napredak internet



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tehnologija, multimedijalnih sistema i digitalnih platformi za učenje promenio je načine na koje se znanje prenosi, usvaja i deli. Digitalni alati su evoluirali od pomoćnih sredstava do ključnih komponenti savremenih pedagoških modela, omogućavajući fleksibilna, studentima prilagođena i praktično orijentisana okruženja za učenje.

U okviru ovog koncepta, multimedijalno učenje se pokazalo kao efikasan pristup za podučavanje složenih tehničkih oblasti. Multimedijalno učenje podrazumeva da studenti formiraju mentalne modele integracijom verbalnih i vizuelnih informacija, što dovodi do boljeg razumevanja sadržaja u poređenju sa učenjem zasnovanim isključivo na tekstu.

Ovaj rad predstavlja multimedijalni pristup nastavi tehnologije sito štampe na tekstilu. Prikazani primer pokazuje kako nastava podržana multimedijalnim sadržajima može unaprediti proces podučavanja i usvajanja znanja iz oblasti tekstilne sito štampe, istovremeno ukazujući na mogućnosti primene sličnih pristupa u drugim praktično orijentisanim i procesno zasnovanim oblastima grafičkog i tekstilnog inženjerstva.

Ključne reči: obrazovanje, multimedijalni sistemi, digitalno učenje, tekstilna sito štampa.

1. INTRODUCTION

The education of future textile and graphic engineers is increasingly influenced by the digital transformation of teaching and learning environments [1-4]. Contemporary students are exposed to large volumes of information through various digital channels, which has significantly changed their expectations regarding educational content and methods of knowledge acquisition. As a consequence, traditional lecture-based approaches are often insufficient for explaining technological processes that involve multiple stages, interactions between materials and equipment, and dynamic production parameters [2, 4]. Within engineering education, particular challenges arise when teaching printing technologies. Printing processes are characterized by the simultaneous interaction of mechanical, chemical, physical and visual phenomena, making them difficult to present through static text and images alone [5]. For this reason, educational approaches that combine visual, auditory and interactive elements have attracted considerable attention in recent years [6, 7].

The theoretical foundation of such approaches can be found in the Cognitive Theory of Multimedia Learning, which assumes that meaningful learning occurs when learners actively integrate verbal and visual information into coherent mental representations [6, 8]. Research has demonstrated that appropriately designed multimedia materials can improve understanding, increase learner engagement and reduce cognitive overload, especially when complex technical concepts are involved [6-7].

Screen printing represents one of the most important conventional printing techniques used in textile production. Despite the rapid development of digital printing technologies, screen printing remains widely applied because of its versatility, durability, colour intensity and suitability for large production runs [5, 10]. The process includes a series of interconnected stages, including artwork preparation, screen production, stencil creation, ink preparation,



printing and curing. Understanding the relationships between these stages requires students to visualize process sequences, equipment operation and material behaviour, which often presents difficulties in traditional classroom instruction [10].

Recent advances in digital educational technologies have created opportunities to enhance the teaching of screen printing through multimedia-supported learning environments [1, 3, 4].

Video-based instruction, animated process demonstrations, narrated presentations and interactive learning materials allow students to observe technological procedures repeatedly and at their own pace [7-9].

This paper presents a multimedia-based approach to screen printing education developed according to established multimedia learning principles. The proposed methodology combines structured instructional materials, visual demonstrations and narrated educational content into a unified learning resource. The objective is not only to improve the presentation of screen-printing technology but also to explore how multimedia-supported instruction can contribute to more effective learning outcomes in textile and graphic engineering education.

2. THEORETICAL BACKGROUND OF MULTIMEDIA LEARNING

Multimedia learning represents one of the most influential approaches in contemporary educational practice [6, 8]. According to the Cognitive Theory of Multimedia Learning, learners achieve deeper understanding when information is presented through a combination of verbal and visual representations rather than through text alone [6]. Educational materials designed according to multimedia principles support active cognitive processing, facilitate knowledge construction and improve long-term retention [8, 9].

Several multimedia design principles have been identified as particularly important for technical and engineering education. These include the multimedia principle, coherence principle, signaling principle, spatial and temporal contiguity principles, modality principle and segmentation principle [6, 8].

The application of these principles is especially relevant when teaching technological processes that involve multiple interconnected stages and dynamic production operations [7, 9].

Screen printing education represents a suitable field for applying multimedia learning because students must simultaneously understand equipment configuration, stencil preparation, ink transfer mechanisms and substrate interaction [10]. These concepts are often difficult to explain through static textual descriptions alone, making multimedia-supported instruction particularly valuable [7, 8].

3. SCREEN PRINTING AS A COMPLEX EDUCATIONAL TOPIC

Screen printing remains one of the most widely used printing technologies in textile production and industrial decoration applications [5, 10]. Despite the growth of digital

printing technologies, screen printing continues to be important because of its versatility, durability and suitability for a wide range of textile applications.

The educational process involves teaching numerous theoretical and practical concepts, including screen preparation, stencil production, image transfer, ink selection, printing parameters and curing procedures. Students are required to understand not only individual process stages but also their interactions and influence on final print quality [10].

Visual demonstrations and multimedia-supported explanations can significantly contribute to improved understanding of screen printing technology and facilitate the acquisition of practical knowledge.

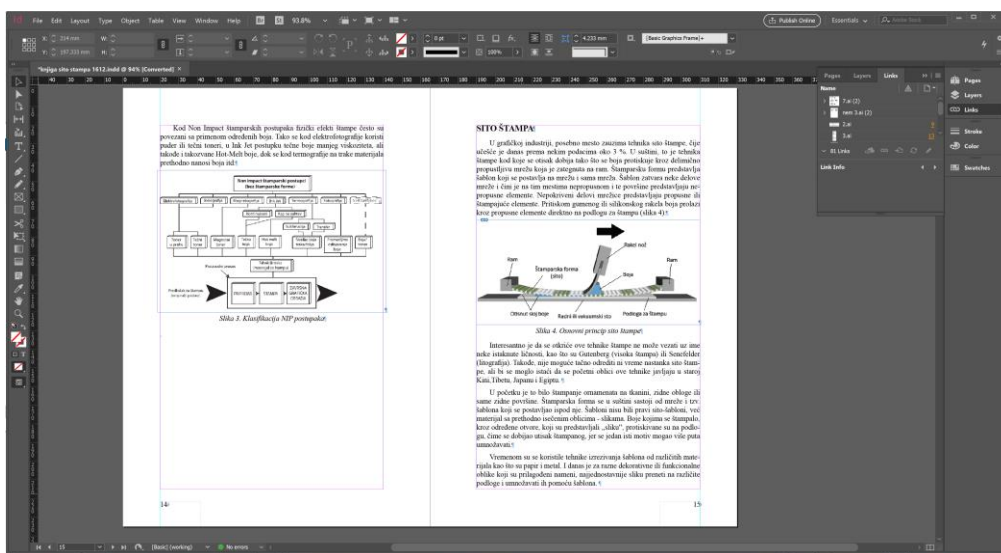


Figure 1: Initial instructional material prepared for screen-printing education

4. DEVELOPMENT OF MULTIMEDIA EDUCATIONAL MATERIAL FOR SCREEN PRINTING

The development of the educational material followed a structured workflow based on multimedia learning principles [6-9].

Table 1: Application of multimedia learning principles in the development of the screen-printing lesson

Multimedia learning principle	Application in the developed lesson
Multimedia principle	Combination of narration, images and diagrams
Coherence principle	Removal of unnecessary text and decorative elements from slides
Signaling principle	Emphasis on key concepts and process stages
Spatial contiguity principle	Positioning of the avatar close to visual content
Modality principle	Use of spoken narration instead of extensive on-screen text
Segmentation principle	Division of the lesson into smaller instructional units

Table 1 summarizes the multimedia learning principles incorporated into the development of the educational material. The practical implementation of these principles throughout the lesson creation process is illustrated in Figures 1–9.

The instructional material was initially prepared in digital format containing textual explanations and graphical representations of screen-printing processes.

The prepared material was then transformed into a PowerPoint presentation. Detailed explanations were placed within speaker notes, while slides contained only essential information and supporting visuals.

This approach reduces unnecessary cognitive load and supports learner attention in accordance with multimedia learning principles [6, 8].

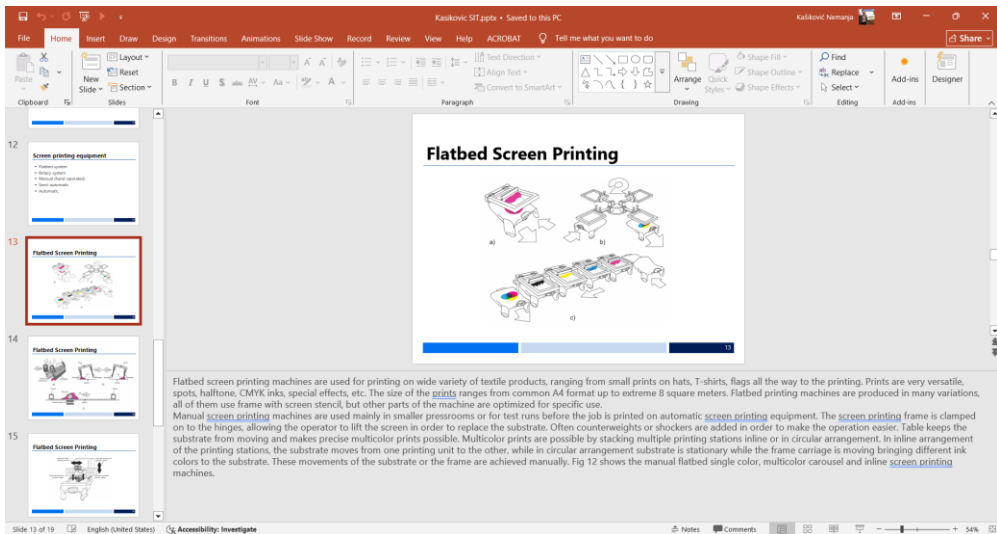


Figure 2: Transformation of instructional content into a PowerPoint presentation following the coherence principle

Following the preparation of the presentation, the Studio D-ID platform was used for multimedia lesson creation.

A new project was created, and the lesson template selected according to educational requirements.

A personal avatar representing the lecturer was selected and positioned in the lower-right corner of the presentation frame.

This placement was chosen to maintain spatial contiguity between narration and visual content while avoiding obstruction of important graphical elements [6, 8].

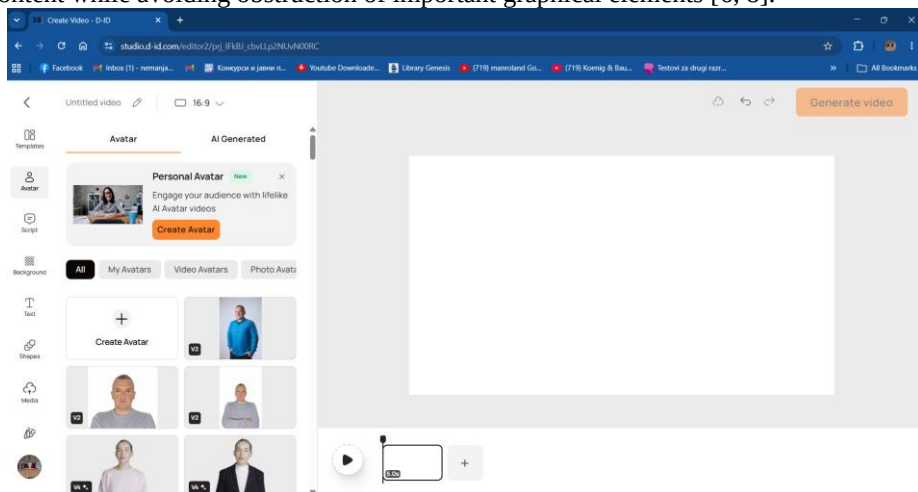


Figure 3: Selection of a personal avatar for multimedia lesson creation within Studio D-ID

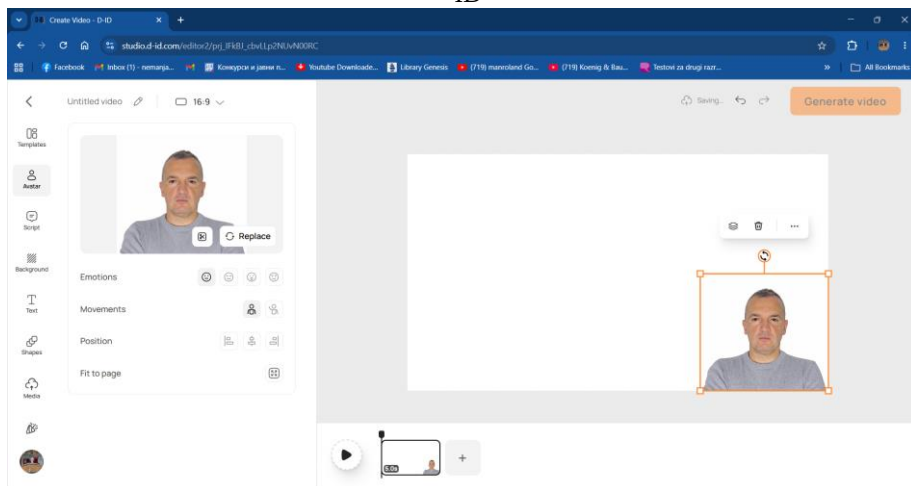


Figure 4: Implementation of the spatial contiguity principle through avatar placement



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Relevant visual materials illustrating screen-printing processes were then selected and integrated into the lesson. The platform enables the incorporation of images, presentations and additional multimedia resources into individual learning segments.

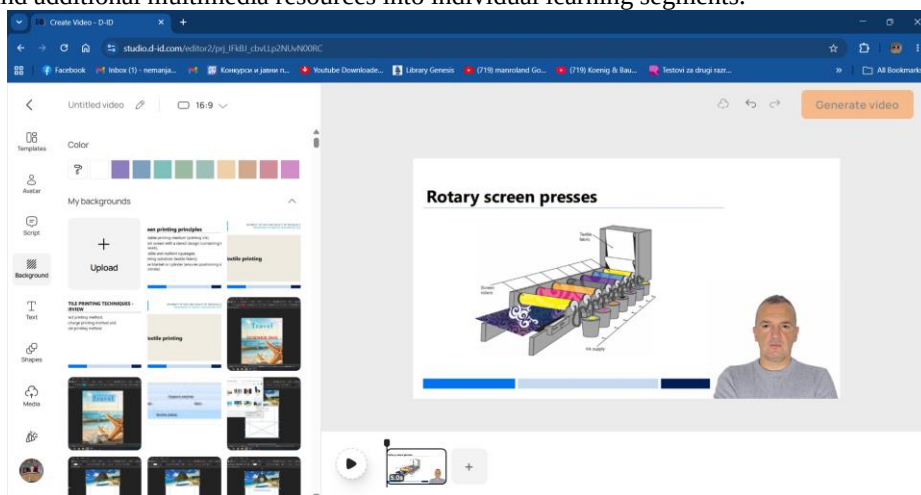


Figure 5: Integration of visual materials into the multimedia lesson

All verbal explanations were entered into the script section of the platform. The system allows the selection of narration language, voice characteristics and speech rate. These options provide flexibility for adapting instructional materials to different educational contexts and learner needs.

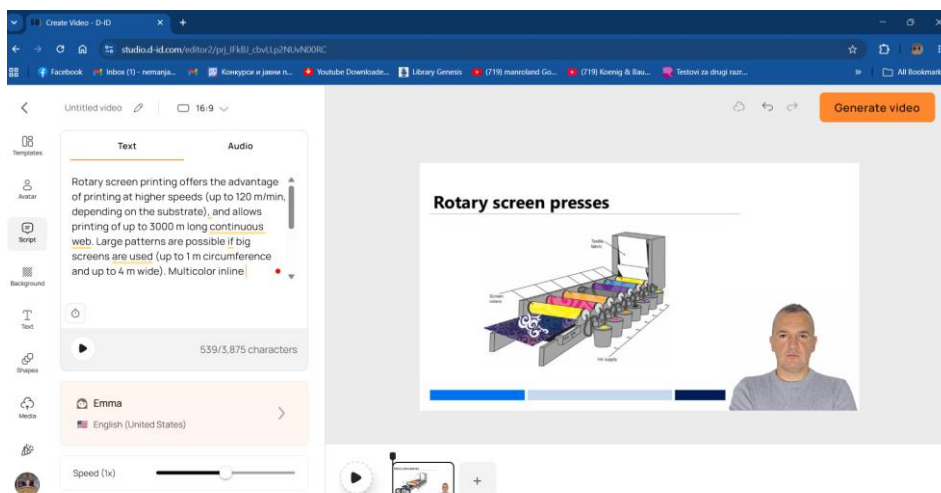


Figure 6: Script preparation for narrated multimedia instruction

After script preparation, an appropriate voice profile and speech configuration were selected. Such customization contributes to improved learner engagement and presentation clarity.

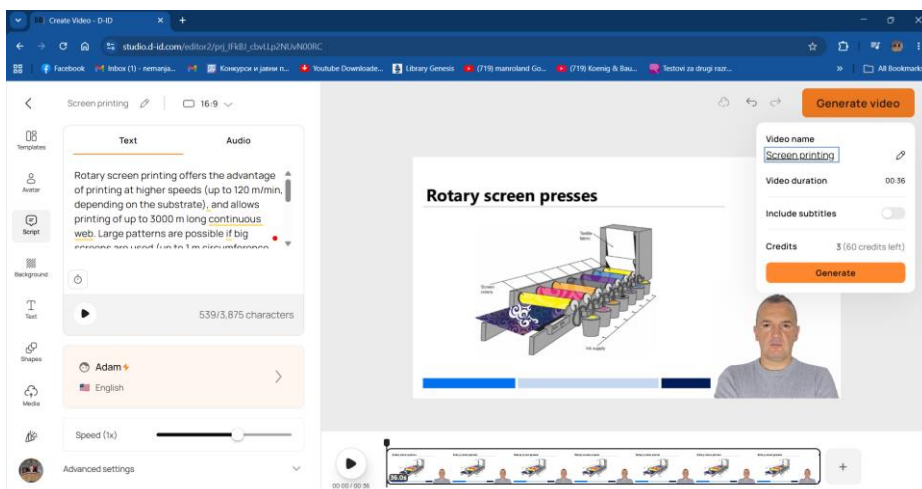


Figure 7: Application of the modality principle through narrated instruction

After completing the preparation process, the multimedia lesson was generated automatically by the platform. The resulting educational material was then downloaded and prepared for classroom, online and blended-learning applications.

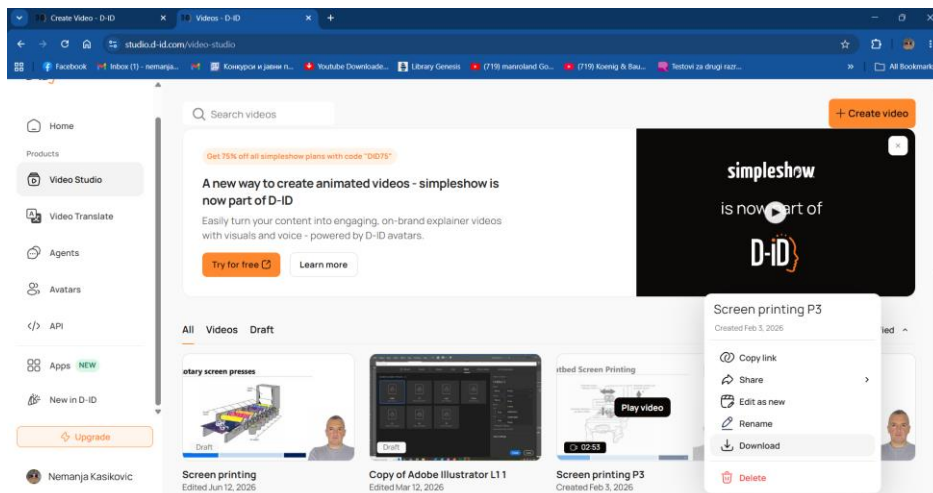


Figure 8: Generation and export of the final multimedia educational material

5. CASE STUDY: MULTIMEDIA LESSON ON SCREEN PRINTING

The developed multimedia lesson presents the fundamentals of screen-printing technology, including flatbed and rotary screen-printing systems, stencil formation, ink transfer mechanisms and process characteristics. The lesson combines narration, visual demonstrations and animated explanations into a single educational resource designed according to multimedia learning principles.

The complete educational video developed within this study is publicly available and can be accessed through the following link:

<https://www.youtube.com/watch?v=X3X4TTuCLuM&t=35s>

The video enables students to observe process stages repeatedly, supporting self-paced learning and reinforcing theoretical concepts through synchronized visual and verbal explanations.

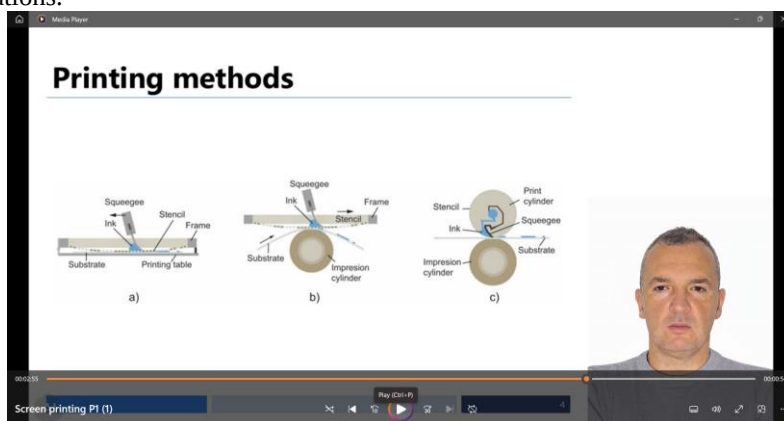


Figure 9: Final multimedia lesson on screen-printing technology available through an online video platform

The developed multimedia lesson was designed according to several established multimedia learning principles. Table 2 summarizes the development workflow of the multimedia lesson and links each phase of the process with the corresponding figure presented in this paper.

Table 2: Workflow for multimedia lesson development

Phase	Activity	Related figure
Content preparation	Preparation of instructional material	Figure 1
Presentation design	Conversion into PowerPoint format	Figure 2
Avatar creation	Selection and positioning of avatar	Figures 3-4
Multimedia integration	Uploading visual material	Figure 5
Narration preparation	Script writing and voice selection	Figures 6-7
Video generation	Exporting the final lesson	Figure 8
Final educational resource	Published multimedia lesson	Figure 9



6. DISCUSSION

The proposed methodology demonstrates how multimedia learning principles can be incorporated into screen-printing education. By combining structured instructional content, visual demonstrations, narration and AI-assisted presentation technologies, educational material becomes more accessible and engaging for students.

The methodology offers several advantages, including flexibility of delivery, support for online and blended learning, content reusability and increased student engagement. Furthermore, the approach can be adapted to other textile and printing technologies where visualization of complex processes is required.

The use of AI-supported multimedia tools should not be considered a replacement for traditional teaching methods but rather a complementary educational resource that enhances knowledge transfer and improves accessibility to instructional content.

Despite the advantages, the development of multimedia educational materials requires considerable preparation time, technical competencies and access to specialized software platforms. Furthermore, the effectiveness of such materials depends on instructional design quality rather than technology itself.

7. CONCLUSION

This paper presented a multimedia-based methodology for teaching screen-printing technology. The proposed approach combines instructional design principles, multimedia learning theory and AI-supported content-generation tools to create educational materials suitable for contemporary engineering education.

The presented case study demonstrates the practical workflow for developing multimedia lessons and highlights the potential benefits of integrating visual, verbal and interactive educational resources into screen-printing instruction.

Future research will focus on empirical evaluation of learning outcomes through experimental studies involving student groups, questionnaires and statistical analysis of educational effectiveness. Such investigations will provide objective evidence regarding the influence of multimedia-supported instruction on learning outcomes in textile and graphic engineering education.

The proposed methodology may serve as a framework for developing multimedia lessons not only in screen printing but also in other textile manufacturing and graphic engineering courses.

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REFERENCES

- [1] Selwyn, N. (2015). *Education and Technology: Key Issues and Debates*. Bloomsbury Publishing.
- [2] Van Dijck, J., Poell, T., de Waal, M. (2018). *The Platform Society: Public Values in a Connective World*. Oxford University Press.
- [3] Decuypere, M., Grimaldi, E., Landri, P. (2021). Critical studies of digital education platforms. *Critical Studies in Education*, 62(1), 1–16.
- [4] Williamson, B., Eynon, R., Potter, J. (2020). Pandemic politics, pedagogies and practices: Digital technologies and distance education during the coronavirus emergency. *Learning, Media and Technology*, 45(2), 107–114.
- [5] Kipphan, H. (2018). *Handbook of Print Media*. Springer.
- [6] Mayer, R.E. (2021). *Multimedia Learning* (3rd Edition). Cambridge University Press.
- [7] Fiorella, L., Mayer, R.E. (2021). *The Cambridge Handbook of Multimedia Learning*. Cambridge University Press.
- [8] Moreno, R., Mayer, R.E. (2007). Interactive multimodal learning environments. *Educational Psychology Review*, 19(3), 309–326.
- [9] Martin, F., Sun, T. (2024). Multimedia learning in engineering education: Emerging trends and applications. *Computers & Education*.
- [10] Smith, B. (2021). *Textile Printing Technologies and Applications*. Woodhead Publishing.
- [11] Kašiković, N., Glušac, D., Premčevski, V., Anđelković, A., Tasić, N. (2025). Razvoj obrazovne platforme ASKING za učenje desktop publishing alata. Proceedings of Trendovi razvoja.
- [12] Kašiković, N., Glušac, D., Premčevski, V., Anđelković, A., Tasić, N. (2025). Using Studio D-ID (Creative Reality Studio) in educational platform ASKING. Proceedings of the International Conference on Digital Education Trends and Challenges.