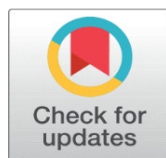


# THE IMPACT OF ARTISTIC ABILITY ON LEARNING OUTCOMES OF DIGITAL MEDIA TECHNOLOGY FOR UNDERGRADUATES BY LEARNING STRATEGIES AND SELF-EFFICACY

Saihua Xu <sup>1</sup>  , Muhamad Abdul Aziz Ab.Gani <sup>2</sup>  

<sup>1</sup> College of Creative Arts, Universiti Teknologi MARA, Perak Branch, Bandar Seri Iskandar, 32610, Perak, Malaysia

<sup>2</sup> College of Creative Arts, Universiti Teknologi MARA, Perak Branch, Bandar Seri Iskandar, 32610, Perak, Malaysia



**Received** 25 February 2026

**Accepted** 21 March 2026

**Published** 16 April 2026

## Corresponding Author

Muhamad Abdul Aziz Ab.Gani,  
[aziz354@uitm.edu.my](mailto:aziz354@uitm.edu.my)

## DOI

[10.29121/shodhkosh.v7.i1.2026.7640](https://doi.org/10.29121/shodhkosh.v7.i1.2026.7640)

**Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**Copyright:** © 2026 The Author(s). This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

With the license CC-BY, authors retain the copyright, allowing anyone to download, reuse, re-print, modify, distribute, and/or copy their contribution. The work must be properly attributed to its author.



## ABSTRACT

With the global digital economy increasingly adopting Outcome-Based Education (OBE), it is essential to elucidate the mechanisms underlying technical mastery in Digital Media Technology (DMT). This study examines the influence of Artistic Ability on DMT learning outcomes among undergraduates, focusing on the parallel mediating effects of Digital Self-Efficacy and Learning Strategies. Drawing on Social Cognitive Theory and Self-Regulated Learning Theory, the research employs an integrated mediation model within a quantitative, cross-sectional survey framework. Data were obtained from 286 undergraduate students participating in project-driven DMT programs, and Structural Equation Modeling (SEM) was used to demonstrate that Artistic Ability is a significant predictor of DMT learning outcomes ( $\beta = 0.184, p = 0.001$ ). Additionally, this relationship is significantly mediated by Digital Self-Efficacy ( $\beta = 0.131, p < 0.001$ ) and Learning Strategies ( $\beta = 0.111, p < 0.001$ ). The results indicate that although innate creative talent serves as an important catalyst, technical proficiency is primarily shaped by psychological confidence and systematic behavioral regulation. This study offers a strategic framework for educational institutions to enhance digital adoption by promoting self-efficacy and metacognitive debugging practices within creative-technical curricula.

**Keywords:** Digital Media Technology, Artistic Ability, Digital Self-Efficacy, Learning Strategies, Smart-PLS, Higher Education

## 1. INTRODUCTION

In the fast-changing digital age, Digital Media Technology (DMT) has emerged as a vital pillar of modern higher education, immediately improving academic performance, critical thinking, and inclusivity for a diverse student body [Yuan et al. \(2025\)](#). Driven by the global expansion of the digital media business, educational frameworks in fast-growing economies changed toward Outcome-Based Education (OBE). This student-centered and results-oriented approach, which is consistent with international Washington Accord standards, prioritises practical competency and advanced technical abilities above traditional rote testing. DMT programs currently successfully integrate computer science,

creative design, and media studies into project-driven environments that simulate real-world business scenarios through specialized pedagogical methods such as micro-lectures and school-enterprise collaborations. Educators use digital platforms such as Moodle, Canva, and game-based media to translate abstract concepts into engaging, concrete experiences that boost student motivation and meet various learning requirements [Sun and Liu \(2019\)](#), [Li \(2023\)](#), [Charlina et al. \(2025\)](#).

Despite the widespread availability of advanced digital tools and e-learning platforms such as Zoom and Microsoft Teams, a substantial gap remains between technical potential and actual student accomplishment. International examinations, such as the ICILS, frequently show that a significant percentage of students score below basic competency levels, indicating a severe knowledge gap in the deployment of digital resources [Hammer et al. \(2021\)](#), [Alzubi \(2023\)](#). While core artistic aptitude is regarded as necessary for success in creative technology, a distinct gulf remains between intrinsic aesthetic talent and the technical proficiency needed to understand sophisticated software. Such a disparity is frequently compounded by educators' limited skill sets; even when faculty have extensive educational knowledge, their technical abilities may be limited, necessitating structured training in integrating resources and in creative creation [Yixi et al. \(2024\)](#), [Naz and Latif \(2024\)](#). This implies that the relationship between artistic aptitude and learning results is complex, mediated by the student's social setting and their behavioural approach to technology.

Central to navigating this complexity are the constructs of self-efficacy and learning strategies. Grounded in Social-Cognitive Theory and the TPACK framework, digital media self-efficacy serves as a vital psychological bridge, shaping a student's confidence in mastering new skills and their persistence in the face of the steep learning curves inherent in DMT [Pumptow, and Brahm \(2021\)](#), [Dong \(2025\)](#). This confidence is often shaped early by the home digital ecosystem and parental modeling, which serve as architects of a student's functional relationship with technology [Hammer et al. \(2021\)](#). Furthermore, this self-efficacy is activated through specialized learning strategies, ranging from metacognitive planning and gamification to social media-assisted assignments, which enable students to bypass algorithmic echo chambers and achieve deeper cognitive, affective, and psychomotor mastery [Hu et al. \(2024\)](#), [Istiqomah and Na'imah \(2025\)](#). Without a robust sense of self-efficacy and the application of disciplined, self-regulated learning strategies, even students with high artistic talent may struggle to achieve the technical benchmarks necessary for modern socioeconomic success [Naz and Latif \(2024\)](#), [Bonnes et al. \(2020\)](#).

Despite the clear theoretical connections among these variables, empirical research examining their combined impact within the undergraduate DMT experience remains limited, particularly regarding how media-didactical competence is fostered in resource-constrained settings. While frameworks like Self-Determination Theory (SDT) highlight the importance of autonomy and competence, few studies examine how a student's social origin and psychological self-evaluation simultaneously influence their media behavior. To address this void, this study investigates the impact of artistic ability on learning outcomes, with specific mediating roles for learning strategies and self-efficacy. By examining these underlying mechanisms, the research provides a strategic roadmap for educational institutions to optimize digital adoption, align technological advancement with local cultural norms, and cultivate highly skilled, adaptable graduates prepared for the complexities of the globalized digital market.

## 2. LITERATURE REVIEW

### 2.1. THE PARADIGM SHIFT IN DIGITAL MEDIA TECHNOLOGY (DMT) EDUCATION

Digital Media Technology (DMT) is evolving as a global paradigm change from teacher-led teaching to decentralised, technology-driven ecosystems powered by the Internet of Things [Rodney \(2020\)](#). It contends that this transition is a pedagogical need, necessitating student-centered environments that prioritise creative thinking and technical fluency to keep up with the rapid expansion of the global digital economy [Istiqomah and Na'imah \(2025\)](#).

Furthermore, the incorporation of social media and deep learning algorithms has transformed media education into an intelligent, participatory model, requiring undergraduates to have the adaptive strategies required to navigate an interconnected, data-driven digital landscape [Raja \(2020\)](#), [Li et al. \(2022\)](#).

### 2.2. ARTISTIC ABILITY: THE CATALYST OF CREATIVE COMPUTATION

Content Knowledge is increasingly recognized as an essential artistic skill for managing complex digital operations and acts as a functional catalyst for the Fourth Industrial Revolution, humanizing digital change and pushing the radical

thinking required for innovation [Schiuma \(2017\)](#). Its computational modeling indicates that creative thinking skills play an important role in human-computer interaction (HCI) frameworks [Li \(2025\)](#).

Moreover, [Zhu and Sheng \(2024\)](#) show that AI and virtual systems provide the foundation for improvement, and the individual's creative potential remains the primary motivator. Moreover, it is suggested that computational agents work best as extensions of human agency, so the authenticity of digital art emerges from the artist's ability to direct these agents and human creativity as the indispensable driver, providing a technical guide towards effective outputs [Bahl \(2024\)](#).

### 2.3. THE MEDIATING ROLE OF DIGITAL SELF-EFFICACY

According to social-cognitive theory, digital self-efficacy acts as a psychological link between a student's basic talent and subsequent achievement. According to [Ibrahim and Aldawsari \(2023\)](#), students' confidence in their digital capabilities had a substantial impact on their academic achievement. Academic self-efficacy regulates students' interactions with technology [Parmaksız \(2022\)](#).

Additional research has confirmed the role of integrated mediation frameworks, indicating that digital self-efficacy is the primary mechanism that translates both literacy and personality traits into better learning outcomes and professional entrepreneurial goals [Yuan et al. \(2025\)](#), [Ta et al. \(2025\)](#).

### 2.4. LEARNING STRATEGIES AS REGULATORY MECHANISMS

Successful use of Digital Media Technology (DMT) necessitates a systematic approach to cognitive management, with learning strategies described as cybernetic regulatory mechanisms that function through both proactive planning and reactive adjustments. A stated control system, developed within the Knowledge, Belief, Commitment, and Planning (KBCP) framework, shows that self-regulation depends on a student's purposeful commitment to structured planning [McDaniel and Einstein \(2020\)](#).

Most recently, [Silva et al. \(2024\)](#) demonstrated that in technical computing environments, these metacognitive strategies serve as essential debugging tools in the learning process. By serving as the internal governor of the educational experience, these regulatory mechanisms ensure that artistic talent is applied efficiently, transforming raw creative effort into the autonomous technical mastery required for complex digital media production [Peña-Ayala and Cárdenas-Robledo \(2019\)](#).

### 2.5. SYNTHESIS: TOWARD AN INTEGRATED MEDIATION MODEL

The foregoing analysis shows that the transition from artistic genius to digital media proficiency is a complex process mediated by psychological and cognitive elements. Thus, [Cheung \(2022\)](#) meta-analytic methodology proposed that an integrated mediation model is required to capture the full complexity of indirect effects.

While, [Li and Shen \(2026\)](#) proposed an anatomy of integration that combines environmental, psychological, and behavioural factors into a single framework to achieve a robust understanding of professional mastery by linking the creative catalyst of artistic ability with the dual mediators of digital self-efficacy and learning strategies, resulting in a unified theory of Digital Media Technology education [Cheung \(2022\)](#), [Li and Shen \(2026\)](#).

### 2.6. THEORETICAL FRAMEWORK

This study's integrated mediation model is based on the theoretical convergence of Social Cognitive Theory [Bandura \(1986\)](#) and Self-Regulated Learning Theory [Zimmerman \(2000\)](#) and provides critical cognitive and behavioral foundations for mastery of Digital Media Technology (DMT). Social Cognitive Theory establishes a key link between a student's artistic ability and digital self-efficacy to determine motivation and persistence. Self-Regulated Learning Theory explains how Learning Strategies allow students to actively plan, monitor, and alter their complex technical workflows. According to the study, creative talent translates into quantitative learning outcomes through similar psychological and behavioral pathways.

### 3. METHODOLOGY

#### 3.1. RESEARCH DESIGN

This study employs a quantitative, explanatory research methodology to examine the impact of artistic ability on learning outcomes in Digital Media Technology (DMT). The study employs a cross-sectional survey to test a parallel mediation model, drawing on [Li and Shen \(2026\)](#) integrated anatomy approach. This framework enables empirical validation of the theoretical link between Digital Self-Efficacy and the regulatory governor of Learning Strategies, which connects innate talent to technological competence.

#### 3.2. PARTICIPANTS AND SAMPLING

The study examines the factors influencing digital media technology through an online survey platform from January to March 2026, targeting undergraduate students currently enrolled in universities that prioritize Outcome-Based Education (OBE) and multi-disciplinary, project-driven environments. A total of 315 people participated in the survey, representing a diverse range of academic backgrounds within the creative and technical sectors. After removing invalid questionnaires due to missing responses or straight-lining, the final sample comprised 286 participants, with 47.90% female ( $n = 137$ ) and 52.10% male ( $n = 149$ ). Regarding data sufficiency, [Schumacker and Lomax \(2010\)](#) state that a sample size of more than 200 participants is considered sufficient for conducting complex Structural Equation Modeling (SEM) and obtaining consistent parameter estimates, whereas [Lakens and Ravenzwaaij \(2022\)](#) emphasize the need to justify sample-size adequacy.

#### 3.3. INSTRUMENTS

This study uses a 5-point Likert scale, with options ranging from strongly agree to strongly disagree, to assess the research model's four key dimensions: creative ability, digital self-efficacy, learning methodologies, and DMT learning outcomes. When modifying and constructing the scales, we used a thorough translation and back-translation approach to ensure language correctness and conceptual consistency across all items. We paid special attention to the items' contextual relevance to the higher education scene, specifically connecting radical creative constructions [Schiuma \(2017\)](#) and debugging learning behaviours [Silva et al. \(2024\)](#) with contemporary pedagogical nuances. After collecting data, SPSS 21.0 and Smart-PLS were used to validate the integrated mediation framework.

#### 3.4. DATA ANALYSIS PROCEDURE

According to the meta-analytic framework for synthesizing indirect effects [Cheung \(2022\)](#), data analysis is conducted in seven sequential steps. First, a common method bias evaluation was performed using Harman's single-factor test to confirm that self-reported measures did not introduce homogeneity bias, and internal consistency was assessed using Cronbach's alpha coefficients with a retention threshold of 0.70. The ideal factorial structure was then identified using Confirmatory Factor Analysis (CFA) using Smart-PLS. Fourth, construct validity was proven by assessing convergent and discriminant validity using AVE and CR values, ensuring that Artistic Ability is distinct from DMT Mastery.

Finally, descriptive statistics and Pearson's correlation analysis were run in SPSS 21.0 to identify baseline associations. The parallel indirect effects of Digital Self-Efficacy and Learning Strategies were examined using a non-parametric bootstrapping method with 5,000 resamples. Model structural integrity was assessed using the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). According to conservative thresholds established by [Hair et al. \(2022\)](#), the model required an SRMR below 0.08 and an NFI above 0.90, indicating that the model-implied covariance matrix aligns with the observed data and supports the validity of the proposed mediation paths.

### 4. RESULTS AND ANALYSIS

#### 4.1. DESCRIPTIVE STATISTICS

Descriptive Statistics are shown in [Table 1](#). Data were collected on a 5-point Likert scale and indicate a generally positive response trend among undergraduates, with scores ranging from 3.55 to 3.84. These statistics help in

understanding the distribution, central tendency, and dispersion of data from the 286 participants. The data are considered normally distributed if Skewness is within  $\pm 2$  and Kurtosis is within  $\pm 7$ .

It also shows that all values fall well within these parameters, confirming that the data are suitable for maximum-likelihood estimation in Smart-PLS.

**Table 1**

Table 1 Descriptive Statistics and Normality Assessment (N = 286)					
Construct	Mean	SD	Variance	Skewness	Kurtosis
Artistic Ability	3.84	0.72	0.518	-0.452	0.125
Digital Self-Efficacy	3.68	0.65	0.422	-0.312	-0.210
Learning Strategies	3.55	0.78	0.608	-0.528	0.412
DMT Learning Outcomes	3.72	0.69	0.476	-0.415	0.188

*Note:* SD = Standard Deviation.

## 4.2. DEMOGRAPHIC PROFILE OF RESPONDENTS

The demographic characteristics shown in Table 2 reflect a well-rounded, academically experienced sample, with a roughly equal gender distribution of about 52.10% male and 47.90% female. Significantly, 70.7% of the cohort consists of Third-Year (38.5%) and Fourth-Year (32.2%) students, ensuring that the data represent individuals with extensive technical exposure to the DMT curriculum. The major age group, 20-21 years (50.7%), confirms a consistent sample of digital natives suitable for assessing self-efficacy and advanced learning outcomes.

**Table 2**

Table 2 Demographic Characteristics (N = 286)			
Demographic Factor	Category	Frequency (n)	Percentage (%)
Gender	Male	149	52.10%
	Female	137	47.90%
Academic Level	First Year	24	8.4%
	Second Year	60	21.0%
	Third Year	110	38.5%
	Fourth Year	92	32.2%
Age	18-19 Years	35	12.2%
	20-21 Years	145	50.7%
	22-23 Years	85	29.7%
	24+ Years	21	7.4%

## 4.3. VALIDITY AND RELIABILITY

The measurement model was evaluated using Smart-PLS to establish the reliability and validity of the latent constructs. In accordance with the guidelines of Hair et al. (2022), model fit was assessed using the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). The SRMR value was 0.042, below the 0.08 threshold, and the NFI was 0.912, indicating an acceptable model fit for structural analysis.

Convergent validity was assessed by calculating the Average Variance Extracted (AVE) and standardized factor loadings. As presented in Table 3, all factor loadings exceeded the recommended threshold of 0.70. The AVE values for Artistic Ability (0.628), Digital Self-Efficacy (0.531), Learning Strategies (0.567), and Learning Outcomes (0.572) are all above the 0.50 criterion, confirming that each construct explains more than half of the variance in its indicators. Internal consistency and reliability metrics, Composite Reliability (CR) and Cronbach's Alpha ( $\alpha$ ), exceed the 0.70 threshold

across all dimensions, indicating high internal stability, and establish a robust foundation for subsequent testing of structural relationships and mediation effects.

**Table 3**

Table 3 Convergent Validity and Reliability Analysis				
Constructs	Standardized Loadings	AVE	CR	A
Artistic Ability	0.762–0.881	0.628	0.894	0.862
Digital Self-Efficacy	0.721–0.844	0.531	0.871	0.824
Learning Strategies	0.703–0.892	0.567	0.912	0.891
DMT Learning Outcomes	0.741–0.855	0.572	0.901	0.875

#### 4.4. PEARSON CORRELATION ANALYSIS AND DISCRIMINANT VALIDITY

Pearson correlation analysis was conducted using SPSS, as shown in Table 4. Mean values for all four variables exceeded the midpoint of the scale, suggesting that participants generally held positive perceptions.

Discriminant validity was established using the Fornell-Larcker criterion to assess the model's structural integrity. According to this method, the square root of the Average Variance Extracted (AVE) for each latent construct, shown as the diagonal bold values in Table 4, must be greater than its highest correlation with any other construct. The results indicate that the square root of the AVE for Artistic Ability (0.792), Digital Self-Efficacy (0.728), Learning Strategies (0.753), and DMT Learning Outcomes (0.756) exceeds all off-diagonal correlation values. These findings confirm that each construct is empirically distinct and that the measurement model does not exhibit multicollinearity.

**Table 4**

Table 4 Pearson Correlation and Discriminant Validity Matrix				
Variables	(1)	(2)	(3)	(4)
(1) Artistic Ability	<b>0.792</b>			
(2) Digital Self-Efficacy	0.421	<b>0.728</b>		
(3) Learning Strategies	0.385	0.452	<b>0.753</b>	
(4) DMT Learning Outcomes	0.448	0.512	0.498	<b>0.756</b>

*Note: Diagonals (bold) are square roots of AVEs; correlations are significant at  $p < 0.01$ .*

#### 4.5. PATH ANALYSIS AND REGRESSION WEIGHTS

The structural model was assessed using SmartPLS 4 to analyze direct relationships among constructs. Significance was determined using a nonparametric bootstrap procedure with 5,000 resamples, which yielded t-values and p-values. As indicated in Table 5, all hypothesized direct paths were statistically significant ( $p < 0.05$ ). Artistic Ability emerged as a strong predictor of both Digital Self-Efficacy ( $\beta = 0.421$ ,  $t = 8.452$ ) and Learning Strategies ( $\beta = 0.385$ ,  $t = 7.619$ ). Additionally, both mediators and the direct path to DMT Outcomes ( $\beta = 0.184$ ,  $t = 3.457$ ) remained significant, thereby confirming the model's structural integrity and establishing a foundation for mediation testing.

**Table 5**

Table 5 Results of Direct Paths in the Structural Model				
Relationships	Path Coeff. ( $\beta$ )	t-value	p-value	Result
Artistic Ability → Digital Self-Efficacy	0.421	8.452	< .001	Significant
Artistic Ability → Learning Strategies	0.385	7.619	< .001	Significant
Digital Self-Efficacy → DMT Outcomes	0.312	6.222	< .001	Significant
Learning Strategies → DMT Outcomes	0.289	5.816	< .001	Significant
Artistic Ability → DMT Outcomes	0.184	3.457	0.001	Significant

#### 4.6. MEDIATION ANALYSIS VIA BOOTSTRAPPING

The mediation effects were evaluated in Smart-PLS 4 using a non-parametric bootstrapping procedure with 5,000 resamples to determine the significance of the indirect paths, with 95% bias-corrected confidence intervals. As indicated in Table 6, the results confirm that Artistic Ability has a significant positive indirect effect on DMT Learning Outcomes through both Digital Self-Efficacy ( $\beta = 0.131$ ) and Learning Strategies ( $\beta = 0.111$ ). Because the confidence intervals for both paths do not include zero (the LLCIs and ULCIs are both positive, the dual-mediation model is empirically supported. These findings indicate that psychological confidence and behavioral regulation are essential mechanisms for translating creative talent into technical success.

**Table 6**

Table 6 Results of Indirect (Mediation) Paths					
Indirect Relationships	Effect	LLCI	ULCI	p-value	Result
Artistic Ability → Self-Efficacy → Outcomes	0.131	0.084	0.182	< .001	Significant
Artistic Ability → Learning Strategies → Outcomes	0.111	0.065	0.160	< .001	Significant

#### 4.7. DISCUSSION OF THE STUDY

The primary objective of this study was to investigate the influence of artistic ability on learning outcomes in Digital Media Technology (DMT) among undergraduates. We focused particularly on the mediating roles of digital self-efficacy and learning strategies. The findings offer robust empirical support for an integrated mediation model. Although innate talent is a significant predictor of success, its effect primarily operates through psychological and behavioral mechanisms.

The findings confirm that artistic ability significantly predicts DMT learning outcomes ( $\beta = 0.184$ ,  $p = 0.001$ ) and serves as a catalyst for creative computation, consistent with the result of Schiuma (2017). However, the relatively lower direct path coefficient, compared to the mediated paths, suggests that innate talent alone is insufficient in a technical DMT environment. The progression from aesthetic creativity to technical mastery requires digital literacy and confidence to navigate complex software interfaces effectively Bahl (2024).

Additionally, digital self-efficacy significantly mediates the relationship between artistic ability and learning outcomes ( $\beta = 0.131$ ), which supports Bandura (1986) Social Cognitive Theory, that students with high artistic talent are more likely to develop confidence in their digital capabilities and to persist in mastering DMT tools. Because psychological confidence drives the potential to actual performance, especially when facing challenges in a specialty, according to Ibrahim and Aldawsari (2023). Finally, the results show that learning strategies significantly mediate the effect of artistic ability on technical outcomes ( $\beta = 0.111$ ), supporting Zimmerman (2000) Self-Regulated Learning Theory in the DMT context. Artistic students who use structured metacognitive planning and systematic problem-solving behaviors Silva et al. (2024) are better prepared for the iterative nature of digital production. These strategies regulate the educational process and ensure that creative efforts are directed efficiently rather than inconsistently.

#### 5. CONCLUSION

The findings indicate that mastery of Digital Media Technology is not merely a product of innate artistic talent but is a complex construction of psychological confidence and disciplined behavioral regulation, successfully validating an integrated mediation framework, by demonstrating that Digital Self-Efficacy and Learning Strategies function as essential parallel mediators in translating artistic potential into measurable academic and technical achievement. For educational institutions, these results suggest that fostering creativity alone is insufficient and that implementing interventions that enhance students' technological confidence and equip them with self-regulated learning strategies to bridge the gap between creative vision and technical execution is necessary.

## 6. LIMITATIONS AND FUTURE RESEARCH

Although this study makes significant contributions to the understanding of Digital Media Technology (DMT) pedagogy, several limitations should be noted. First, the use of a cross-sectional design, with data collected at a single point in time, limits the ability to establish causal relationships in the development of artistic ability and technical mastery across a four-year degree program. Second, reliance on self-reported survey instruments may have introduced social desirability bias, leading participants to overestimate their digital self-efficacy or the consistency of their applied learning strategies. Finally, the study's geographic and institutional focus on universities that emphasize Outcome-Based Education (OBE) may limit the generalizability of the findings to institutions that employ traditional, rote-learning approaches or operate in substantially different socio-economic contexts.

To advance this area of research, several strategic directions should be considered. Longitudinal analyses tracking students from entry to graduation would provide insight into how digital self-efficacy develops as technical challenges become more complex. The field would also benefit from experimental approaches, such as gamified learning modules or self-efficacy workshops, to assess whether these interventions can enhance DMT learning outcomes, particularly for students with lower initial artistic ability. In light of the rapid emergence of generative artificial intelligence, future studies should examine how AI-assisted creativity affects students' sense of agency and their dependence on traditional, self-regulated learning strategies. Pursuing these research avenues will help ensure that educational frameworks remain responsive and effective within the evolving global digital landscape.

## CONFLICT OF INTERESTS

None.

## ACKNOWLEDGMENTS

None.

## REFERENCES

- Alzubi, A. M. (2023). The Role of Digital Media Technology in Arabic and English Classes in the Kingdom of Jordan. *Alsuna: Journal of Arabic and English Language*, 6(1), 55–72. <https://doi.org/10.31538/alsuna.v6i1.3419>
- Bahl, A. (2024). Art, Agency, and Computers: Human Perceptions of Creativity in Artistic Processes That Use Computational Agents (Doctoral dissertation, Brown University, Providence, RI).
- Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ.
- Bonnes, C., Leiser, C., Schmidt-Hertha, B., Rott, K. J., and Hochholdinger, S. (2020). The Relationship Between Trainers' Media-Didactical Competence and Media-Didactical Self-Efficacy, Attitudes and Use of Digital Media in Training. *International Journal of Training and Development*, 24(1), 74–88. <https://doi.org/10.1111/ijtd.12171>
- Charlina, C., Septyanti, E., and Mustika, T. P. (2025). Meta Analysis: The Impact of Digital Media on Indonesia Language Learning Outcomes in Elementary and Secondary Schools in Indonesia. *Al-Ishlah: Journal of Education*, 17(4), 8066–8078. <https://doi.org/10.35445/alishlah.v17i4.6353>
- Cheung, M. W. (2022). Synthesizing Indirect Effects in Mediation Models With Meta-Analytic Methods. *Alcohol and Alcoholism*, 57(1), 5–15. <https://doi.org/10.1093/alcalc/agab044>
- Cheung, M. W. L. (2022). *Meta-Analytic Structural Equation Modeling*. Springer Nature. <https://doi.org/10.1093/acrefore/9780190224851.013.225>
- Dong, D. (2025). Self-Determination Theory Perspectives on the Influence of Digital Learning Engagement on Motivation in Extracurricular Learning Activities: Considering the Mediating Role of Digital Self-Efficacy. *Learning and Motivation*, 90, 102135. <https://doi.org/10.1016/j.lmot.2025.102135>
- Hammer, M., Scheiter, K., and Stürmer, K. (2021). New Technology, New Role of Parents: How Parents' Beliefs and Behavior Affect Students' Digital Media Self-Efficacy. *Computers in Human Behavior*, 116, 106642. <https://doi.org/10.1016/j.chb.2020.106642>
- Hu, J., Lai, Y., and Yi, X. (2024). Effectiveness of Social Media-Assisted Course on Learning Self-Efficacy. *Scientific Reports*, 14(1), 10112. <https://doi.org/10.1038/s41598-024-60724-0>

- Ibrahim, R. K., and Aldawsari, A. N. (2023). Relationship Between Digital Capabilities and Academic Performance: The Mediating Effect of Self-Efficacy. *BMC Nursing*, 22(1), 434. <https://doi.org/10.1186/s12912-023-01593-2>
- Istiqomah, N., and Na'imah, N. I. (2025). Education Transformation: Paradigm Shifts in Learning in the Age of Technology. *Journal of Educational Sciences*, 9(3), 1546–1557.
- Li, H., and Shen, G. (2026). Synthesis Discussion: Theoretical Integration and Research Implications. In *The Anatomy of Subjective Well-Being: Linking Built Environment to Life Satisfaction in China* (363–399). Springer Nature Singapore. [https://doi.org/10.1007/978-981-95-4937-5\\_10](https://doi.org/10.1007/978-981-95-4937-5_10)
- Li, J. (2025). Model for the Analysis of Creative Thinking Skills Based on Big Data and Involving Human-Computer Interaction in Art. SSRN. <https://doi.org/10.2139/ssrn.5004896>
- Li, X., Dong, Y., Jiang, Y., and Ogunmola, G. A. (2022). Analysis of the Teaching Quality of College Ideological and Political Education Based on Deep Learning. *Journal of Interconnection Networks*, 22(Suppl. 2), 2143002. <https://doi.org/10.1142/S0219265921430027>
- Li, Y. (2023). Research on the Development Ideas of Online Courses for Digital Media Art Majors Based on OBE Teaching Concept. *Innovation*, 11, 1–11.
- Maxwell, S. E., Kelley, K., and Rausch, J. R. (2008). Sample Size Planning for Statistical Power and Accuracy in Parameter Estimation. *Annual Review of Psychology*, 59, 537–563. <https://doi.org/10.1146/annurev.psych.59.103006.093735>
- McDaniel, M. A., and Einstein, G. O. (2020). Training Learning Strategies to Promote Self-Regulation and Transfer: The Knowledge, Belief, Commitment, and Planning Framework. *Perspectives on Psychological Science*, 15(6), 1363–1381. <https://doi.org/10.1177/1745691620920723>
- Naz, A., and Latif, M. (2024). Digital Media Literacy and Online Learning: Empowering Education Through Digital Apps. SSRN. <https://doi.org/10.2139/ssrn.5067233>
- Parmaksız, İ. (2022). The Mediating Role of Personality Traits on the Relationship Between Academic Self-Efficacy and Digital Addiction. *Education and Information Technologies*, 27(6), 8883–8902. <https://doi.org/10.1007/s10639-022-10996-8>
- Peña-Ayala, A., and Cárdenas-Robledo, L. A. (2019). A Cybernetic Method to Regulate Learning Through Learning Strategies: A Proactive and Reactive Mechanism Applied in U-Learning Settings. *Computers in Human Behavior*, 98, 196–209. <https://doi.org/10.1016/j.chb.2019.03.036>
- Pumptow, M., and Brahm, T. (2021). Students' Digital Media Self-Efficacy and Its Importance for Higher Education Institutions: Development and Validation of a Survey Instrument. *Technology, Knowledge and Learning*, 26(3), 555–575. <https://doi.org/10.1007/s10758-020-09463-5>
- Ringle, C. M., Wende, S., and Becker, J.-M. (2022). SmartPLS 4. SmartPLS GmbH.
- Rodney, B. D. (2020). Understanding the Paradigm Shift in Education in the Twenty-First Century: The Role of Technology and the Internet of Things. *Worldwide Hospitality and Tourism Themes*, 12(1), 35–47. <https://doi.org/10.1108/WHATT-10-2019-0068>
- Sarstedt, M., Ringle, C. M., and Hair, J. F. (2021). Partial Least Squares Structural Equation Modeling. In *Handbook of Market Research* (587–632). Springer. [https://doi.org/10.1007/978-3-319-57413-4\\_15](https://doi.org/10.1007/978-3-319-57413-4_15)
- Schiama, G. (2017). Arts Catalyst of Creative Organisations for the Fourth Industrial Revolution. *Journal of Open Innovation: Technology, Market, and Complexity*, 3(4), 1–12. <https://doi.org/10.1186/s40852-017-0072-1>
- Schumacker, R. E., and Lomax, R. G. (2010). *A Beginner's Guide to Structural Equation Modeling* (3rd ed.). Routledge.
- Silva, L., Mendes, A., Gomes, A., and Fortes, G. (2024). What Learning Strategies Are Used by Programming Students? A Qualitative Study Grounded on the Self-Regulation of Learning Theory. *ACM Transactions on Computing Education*, 24(1), 1–26. <https://doi.org/10.1145/3635720>
- Sun, Y., and Liu, F. (2019). Research on the Cultivation of Professional Applied Talents of Digital Media Technology Based on OBE Mode. In *Proceedings of the International Conference on Contemporary Education and Society Development* (105–108). <https://doi.org/10.2991/iccscd-19.2019.26>
- Ta, H. H., Layeghi, G., Delladio, S., Nguyen, V. H. A., and Caputo, A. (2025). Examining the Impact of Big Five Personality Traits and Digital Competencies on Digital Entrepreneurial Intention: The Mediating Role of Digital Self-Efficacy. *International Entrepreneurship and Management Journal*, 21(1), 112. <https://doi.org/10.1007/s11365-025-01143-z>

- Yixi, W., Prachanant, N., and Buranaphansak, K. (2024). The Development of Training Curriculum for Enhancing the Digital Technology Ability of Digital Media Arts Teachers at Private Colleges in Guangdong Province, People's Republic of China. *Journal of Roi Kaensarn Academi*, 9(10), 1310–1323.
- Yuan, N., Yu, Q., and Liu, W. (2025). The Impact of Digital Literacy on Learning Outcomes Among College Students: The Mediating Effect of Digital Atmosphere, Self-Efficacy for Digital Technology and Digital Learning. *Frontiers in Education*, 10, 1641687. <https://doi.org/10.3389/educ.2025.1641687>
- Zhu, L., and Sheng, Z. (2024). Artificial Intelligence, Virtual Computer Systems, and Interactive Systems: A Holistic Approach to Enhancing Creative Talent in Art Design. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 15(3), 395–411. <https://doi.org/10.58346/JOWUA.2024.I3.026>
- Zimmerman, B. J. (2000). Attaining Self-Regulation: A Social Cognitive Perspective. In *Handbook of Self-Regulation* (13–39). Academic Press. <https://doi.org/10.1016/B978-012109890-2/50031-7>