Salud, Ciencia y Tecnología. 2025; 5:540
doi: 10.56294/saludcyt2025540

ORIGINAL

Application of traditional Chinese auspicious patterns in computer graphic design teaching

Aplicación de patrones auspiciosos chinos tradicionales en la enseñanza de diseño gráfico por computadora

Mengze Yuan[1], Surendheran Kaliyaperumal[2]

[1]Faculty of Social Science, Arts and Humanities, Lincoln University College. Petaling Jaya, Selangor, Malaysia 47301.
[2]I Lincoln University College. Jalan SS 6/12, Petaling Jaya, Selangor, Malaysia.

Cite as: Yuan M, Kaliyaperumal S. Application of traditional Chinese auspicious patterns in computer graphic design teaching. Salud, Ciencia y Tecnología. 2025; 5:540. https://doi.org/10.56294/saludcyt2025540

Submitted: 20-02-2024 **Revised:** 02-07-2024 **Accepted:** 02-12-2024 **Published:** 01-01-2025

Editor: Dr. William Castillo-González

Corresponding Author: Mengze Yuan

ABSTRACT

Introduction: computer graphic designers utilize technology to adapt and blend text, images, color, font, and music to produce emotions and suggest messages to viewers. It makes concepts easier to visualize, supports creative design processes, improves user interfaces, and helps to investigate simulations.
Objective: this study aims to develop an innovative computer graphic design teaching model using traditional Chinese auspicious patterns. Traditional Chinese auspicious patterns are imbued with cultural consequence and symbolism that offer students deeper consideration of visual aesthetics and cultural heritage in computer graphic design.
Method: in this study, a novel horse herd optimized poly-kernel support vector machine (HHO-PSVM) is proposed to forecast student performance in computer graphic design teaching. Student data is collected and analyzed by monitoring and assessing their commitment with computer graphic design teaching activities. The data was preprocessed by normalization. Then features are extracted from independent component analysis (ICA) from preprocessed data.
Results: the findings of this study demonstrate that Chinese auspicious patterns in computer graphic design teaching improve students' understanding of cultural aesthetics and enhance creativity and engagement. A comparison of metrics' numerical results pre and post pattern was implemented. The improvement in recall from 68 % to 90 %, accuracy from 65 % to 89 %, precision from 63 % to 87 %, and F1-score from 64 % to 88 % was positive.
Conclusions: this study contributes to the broader interaction of traditional art forms with digital activities by contributing education in digital design.

Keywords: Chinese Auspicious Patterns; Computer Graphic Design Teaching; Horse Herd Optimized Poly-Kernel Support Vector Machine (HHO-PSVM).

RESUMEN

Introducción: los diseñadores gráficos por computadora utilizan la tecnología para adaptar y mezclar texto, imágenes, color, fuente y música para producir emociones y sugerir mensajes a los espectadores. Hace que los conceptos sean más fáciles de visualizar, apoya procesos creativos de diseño, mejora las interfaces de usuario y ayuda a investigar simulaciones.
Objetivo: este estudio tiene como objetivo desarrollar un modelo innovador de enseñanza de diseño gráfico por computadora utilizando patrones auspiciosos tradicionales chinos. Los patrones auspiciosos tradicionales chinos están imbuidos con consecuencias culturales y simbolismo que ofrecen a los estudiantes una consideración más profunda de la estética visual y el patrimonio cultural en el diseño gráfico por computadora.

Método: en este estudio, se propone una nueva máquina de vectores de soporte polikernel óptima para rebaño de caballos (HHO-PSVM) para predecir el rendimiento de los estudiantes en la enseñanza de diseño gráfico por computadora. Los datos de los estudiantes se recogen y analizan mediante el seguimiento y la evaluación de su compromiso con las actividades de enseñanza de diseño gráfico por ordenador. Los datos fueron preprocesados por normalización. A continuación, las características se extra del análisis de componentes independientes (ICA) a partir de datos preprocesados.
Resultados: los hallazgos de este estudio demuestran que los patrones auspiciosos chinos en la enseñanza del diseño gráfico por computadora mejoran la comprensión de los estudiantes de la estética cultural y aumentan la creatividad y el compromiso. Se realizó una comparación de los resultados numéricos pre y post patrón de métricas. La mejora en la memoria de 68 a 90 %, la precisión de 65 a 89 %, la precisión de 63 a 87 % y la puntuación F1 de 64 a 88 % fue positiva.
Conclusiones: este estudio contribuye a la interacción más amplia de las formas de arte tradicionales con las actividades digitales al contribuir a la educación en diseño digital.

Palabras clave: Patrones Auspiciosos Chinos; Enseñanza del Diseño Gráfico por Ordenador; Máquina de vectores de Soporte Polikernel Óptima para Rebaño de Caballos (HHO-PSVM).

INTRODUCTION

Artists struggle to define the feelings they want to materialize to evoke strong emotions in the audience. Artists want to communicate their emotions through contemplation or tangible beauty; their works need to be suitable, requiring both encoding and decoding to successfully transmit ideological meaning.[1] The critical need to preserve and safeguard these crafts is highlighted by the fact that many traditional folk arts in China are at risk of being lost or subverted, endangering the country's rich cultural legacy.[2] Ethnic traditional costumes are a valuable source of cultural capital and richness that have the potential to greatly revitalize a nation. They are also an intangible cultural treasure that embodies the essence and foundation of national culture.[3] The art of animation is a melting pot of technologies and it has little cultural resonance. Chinese animation should concentrate on its past and culture, learning from it to produce works that are representative of the country's aesthetics and culture.[4] The important regional culture Minnan has developed through the use of aesthetics and technology. A variety of artistic and cultural goods include architectural ornamentation, encouraging folk art, and spiritual fulfillment.[5] Chinese New Year's patterns are a type of standard artwork that are popular at the end of the year and depict the history, way of life, values, and traditions of Chinese culture. They have acquired recognition and are included in the inventory of national intangible cultural treasures, despite being regarded as a significant folk culture that is in danger of disappearing.[6] Figure 1 demonstrates the factors of Chinese traditional pattern.

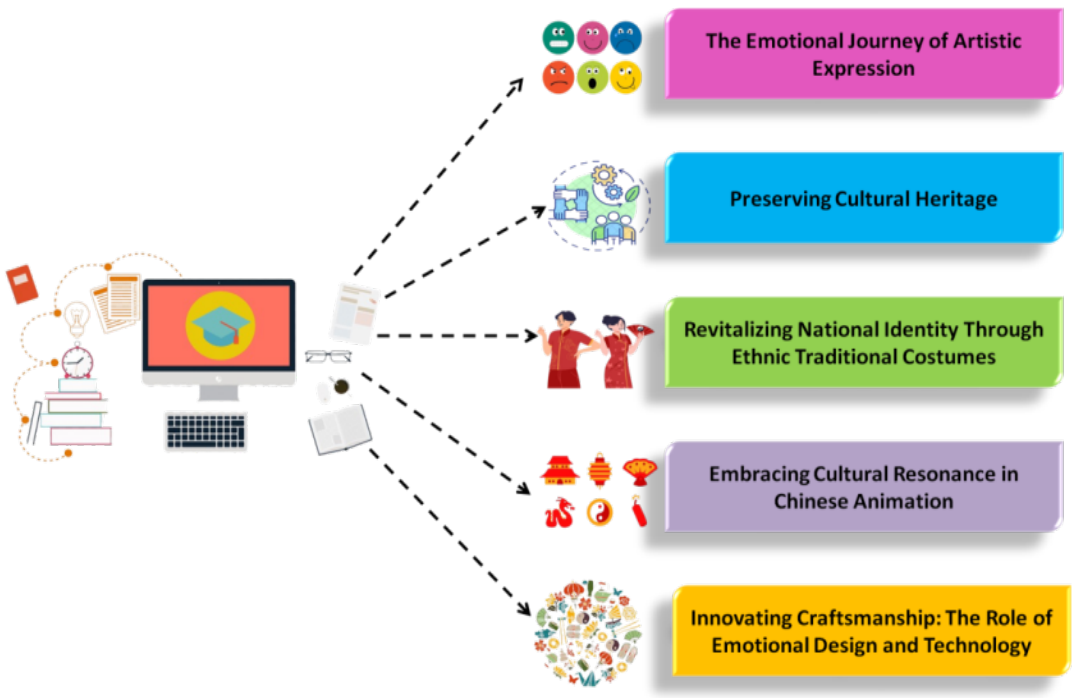

Figure 1. Factors of Chinese traditional pattern

https://doi.org/10.56294/saludcyt2025

Both tangible and intangible assets that have been passed down through the centuries, such as products, artwork, architecture, performing arts, oral traditions, rituals, knowledge, and crafts.[7] The significance of traditional settlements, such as Chinese traditional communities and historic-cultural villages/towns, has been highlighted by objective because of its rich cultural legacy, preservation, tourist value and architecture.[8] To provide a fulfilling experience, goods began to include emotional design in 2004. The interaction design foundation is currently providing an online education, which has raised interest in this discipline.[9] It is difficult to satisfy customer demands when using traditional handmade customization; it requires a lot of work and time. This approach could be improved by learning about grammar and cultural relic knowledge management.[10]

Using virtual reality (VR) technology to improve the viewing experience and foster cross-cultural understanding, the creation of a digital interactive exhibition platform for Intangible Cultural Heritage paper engraving in China was investigated.[11] It showed the possibility for sustainable design and art inheritance by classifying decorative openwork windows in Suzhou traditional gardens using the Comma Separated Values-Network(CSV-Net) image recognition algorithm.[12] Qualitative research methodologies have been applied to the Duntou Blue, a traditional hand-weaving technique from Guangdong Province, China. It examined the creative design techniques used by Duntou Blue, its economic and cultural significance, and the requirement for a sustainable industrial chain approach.[13] To improve knowledge and translate national cultural elements into design materials, digital product design courses used the ancient Miao craft of Miao embroidery. The database boosted accessibility, increased manufacturing efficiency, and broadened the market.[14] To clarify the mathematical reasoning behind traditional Chinese architecture and assist in comprehending its typology and preservation, the study suggested a parametric method for producing Siheyuan variants in a 4D Computer-Aided Design (CAD) environment.[15] To give a theoretical foundation and design guide, integrated historical examples, the method, and cluster analysis to suggest card-based design heuristics for Fuzhou's cultural tourist goods.[16] It addressed the internal and external issues brought by changes in consumer patterns, science, and technology while examining the modern evolution of Chinese traditional needlework and offering a parallel development model.[17] A novel visual design strategy based on cognitive transformation and prototype images was suggested in the research, which also examined the cultural importance of sacrificial symbols in the ChaoshanMid-Autumn Festival.[18] The objective of this study is to develop an innovative computer graphic design teaching model using traditional Chinese auspicious patterns. To forecast student success throughout the teaching process, using a novel HHO-PSVM.

- The program enhances students' visual aesthetics and promotes a better awareness of cultural heritage by introducing traditional Chinese auspicious patterns into graphic design courses.
- This study improves students' creativity and engagement through the integration of symbolic cultural aspects, resulting in more immersive graphic design learning experiences.
- By fusing contemporary technology with traditional art forms, this research presents a fresh perspective to digital design education and advances the field of creative design teaching approaches.

METHOD

The method preprocesses student performance data in graphic design education using min-max normalization, ICA, and a hybrid model. Peer influence, collaboration, and participation increase prediction, and accuracy. Figure 2 represents the proposed methodology flow.

Figure 2. Proposed methodology

Data

The data collection includes comprehensive metrics on student performance in computer graphic design education, with an emphasis on participation, inventiveness, and ratings related to cultural aesthetics. Creativity ratings measure how well students apply traditional Chinese auspicious patterns to develop study, while engagement measures how much students participate in class activities. The significance of these patterns is deliberated by students' ratings on educational aesthetics.

https://doi.org/10.56294/saludcyt2025540

Data Preprocessing using Min-Max Normalization

The min-max normalization technique is used in this study to normalize student performance data, including traditional Chinese auspicious patterns, in computer graphic design instruction. To ensure data homogeneity for accurate machine learning (ML) forecasts, this approach modifies features depending on their greatest and lowest values. Equation (1) displays the min-max normalization formula:

$$b_{scaled} = \frac{b - b_{min}}{b_{max} - b_{min}} \quad (1)$$

The value of normalization is denoted by b_{scaled}, a is an original value. The depiction of b_{max} represents the maximum value and minimum value is represented as b_{min}. This study showed the effects of integrating traditional Chinese auspicious patterns on contemporary design education by normalizing data on student performance and creative indicators in graphic design instruction.

Feature Extraction using Independent Component Analysis (ICA)

A statistical method called ICA is used to predict student performance in computational graphic design from the original data and get rid of artifacts. It works well for planning tasks like gauging students' attention and their responses to customary Chinese lucky patterns. Assuming independent components and mixes are random variables with zero, ICA takes combinations of data with artifacts or noise in this situation. The following equation (2) is a linear representation of the mixing process:

$$A_j = T_1 + T_2 + T_3 + \cdots + T_n + Noise \quad (2)$$

In this instance, the separate source signals are indicated by T_n, while the mixed signals that were seen are represented by A_j. It is assumed that the mean of the mixes and the independent components T are both zero. For instance, the model can be expressed as follows for three sensors in equations (3-5):

$$A_1 = Z_{11}T_1 + Z_{12}T_2 + Z_{13}T_3 + Noise \quad (3)$$
$$A_2 = Z_{21}T_1 + Z_{22}T_2 + Z_{23}T_3 + Noise \quad (4)$$
$$A_3 = Z_{31}T_1 + Z_{32}T_2 + Z_{33}T_3 + Noise \quad (5)$$

The vector-matrix notation for these equations is as follows in equation (6):

$$A = X.T \quad (6)$$

Where, A represents the random vector of mixes, which are the observed signals; T represents the random vector of sources, which are the independent source signals; and X is the mixing matrix, which contains the entries X_{ij}. In this study, the objective of ICA is to determine the unknown unmixing matrix Z that divides the mixed signals into the source signals. The unmixing process can be represented as equation (7):

$$T = Z.A \quad (7)$$

An alternative representation of the mixing matrix X is in equation (8):

$$A = \sum_{i=1}^{n} X_{ij}\, T_j \quad (8)$$

To enhance the comprehension of the influence of customary Chinese auspicious patterns on the creativity and performance of students in graphic design education, examine signals gathered from many sources of student participation and feedback in research. An enhanced comprehension of how cultural factors impact student performance is made possible by the un-mixing matrix Z, which has coefficients of Z_{ij}. In this case; applications of ICA include improving the overall efficacy of the teaching model and extracting relevant engagement indicators. Through, the lens of cultural heritage, insights that lead to superior educational outcomes in digital design can be extracted by precisely measuring the mixing matrix Xand finding its inverse Z.

To predict student performance in computer graphic design teaching using HHO-PSVM

To improve prediction accuracy and flexibility, the HHO-PSVM model is suggested for computer graphic design education. It does this by extracting complicated patterns from student interaction data using a poly-kernel technique. Additionally, it uses HHO to gather parameters optimally, allowing teachers to alter their teaching strategies for better student outcomes.

Poly-kernel support vector machine (PSVM)

With an emphasis on certain styles and techniques, student assignments in computer graphic design are precisely categorized using the PSVM model. By examining inventive use of color and composition, as well as design principles, it appropriately classes student performance. In computer graphic design education, an integrated PSVM classifier provides targeted feedback and personalized learning paths by optimizing prediction based on these criteria.

$$e(z) = Xt.z + a \quad (9)$$

According to equation (9), Xt represents the weight vector and a represents the bias. Z is an abbreviation for an example input. This means that any point above the hyper plane's center meets the mathematical formula.

$$Xt.z + x > 0 \quad (10)$$

Furthermore, each point is isolated from the hyper plane to use equation (10) to satisfy the following mathematical expression:

$$Xt.z + x < 0 \quad (11)$$

It is possible to compute the separation between the two margin hyper planes using equation (11):

$$c(m_1, m_2) = \frac{2}{|Xt|} \quad (12)$$

The distance between the two marginal hyper planes (m_1 and m_2) is given by c. The group label Xt is located at w_t {+1,-1} in equation (12), and the m_1 m_2 $\{(z_1,w_1),(z_2,w),\ldots\ldots (z_m,w_m)\}$ z_s w_s w_s input instances are represented byc.

$$\min\left\{\frac{1}{2}|Xt|^2 + D\sum_{j=1}^{n} s_j\right\} \quad (13)$$

In equation (13), where e denotes a scalar value, Xt represents the weighted vector, and s_j stands for the slack variables. By creating the Lagrangian multipliers, the ideal excessive plane is shown as follows:

$$Maximize\ Xt(\propto) = \sum_{j=1}^{L} \propto_j - \frac{1}{2}\sum_{j=1}^{L}\sum_{i=1}^{L} \propto_j \propto_i w_j w_i l(z_j, z_i) \quad (14)$$

$$Subject\ to\ \sum_{j=1}^{L} w_j \propto_j = 0, 0 \le \alpha_j \le C, \forall j \quad (15)$$

Equations (14) and (15) demonstrate that the non-negative Lagrangian multiplied by the supporting vector, which is the related property of $z_i \propto_1, \propto_2 \ldots\ldots \propto_L \propto_1 > 0$. As a result, a represents the linear discriminating function. Thus, the following can be used to determine the linear discriminating function.

$$e(z) = \left(\sum_{j=1}^{n} \propto_j w_i z_j + x\right) \quad (16)$$

With the use of equation (16) and the PSVM classifier, it is possible to effectively identify the essential characteristics for students' learning prediction. The relevant qualities were weighted and compared using the w_i z_j.

$$\hat{w} = sgn \sum_{j=1}^{m} Xtw_i l(z_j, z_j') \quad (17)$$

The type {1,- 1} is produced by equation (17) when the class label operator Xtw_i is applied. In this instance, the values of the training features are represented by Xt. Positive or negative classification is applied to the supplied category w, based on the signs function sgn.

Horse herd optimization (HHO)

By including horse behavior, the HHO algorithm can be used to simulate and forecast student success in computer graphic design courses. Six features such as engagement techniques, hierarchical behavior, collaborative dynamics, and adaptive learning methods that can be used as analogs for student characteristics and learning mechanisms are incorporated into the algorithm. Students' movements can be quantitatively described to indicate their learning trajectory and engagement level in the context of forecasting student performance in equation (18):

$$T_n = D.U.Z \quad (18)$$

Where U signifies the speed at which they are learning and T_n indicates the location of the n^{th} student.

Engagement (Grazing Mechanism): students interact with instructional materials in a similar way to how horses graze. This interaction can be represented as equation (19):

$$ET_n = h.(WT - JT) \quad (19)$$

The student's interest in graphic design materials is represented by h, while the upper and lower engagement levels are shown by WT and JT, respectively.

Hierarchical Learning (Hierarchy Mechanism): based on peer influence and mentoring, students perform at different levels, resembling the hierarchical behavior of horses. One way to depict hierarchical behavior is as follows in equation (20):

$$F_n = f.C.(T_n - C^*) \quad (20)$$

Where A represents the average performance of peers and f represents the impact of peers on a student's performance.

Collaboration (Sociability Mechanism): social interactions among students provide insight into the collaborative learning element. This has the following mathematical definition in equation (21):

$$QJ_n = FJ.(1 - c) \quad (21)$$

Where c stands for factors like individual performance anxiety or rivalry that hinder collaboration and FJ indicates the group's average degree of cooperation.

Adaptive Learning (defensive Scheme): students modify their learning tactics in response to performance evaluations and classroom dynamics, much like horses have defensive systems. Models for this adaptive learning are included in equation (22):

$$BH_n = b - \sum_{i=1}^{M} C_i \quad (22)$$

Where C_i reflects the difficulties, the learner faces and C denotes a baseline adaptive capability, allowing the student to modify their strategy accordingly. By reducing the loss resulting from inaccurate performance forecasts made using the aforementioned characteristics, the goal function to maximize student performance can be stated as follows in equation (23):

$$Minimize \sum_{j=1}^{L}\left(\frac{1}{2\delta_j^2}\eta_j^2 + \frac{1}{2\delta_j^{*2}}\eta_j^{*2}\right) \quad (23)$$

Where the variation in performance expectations is represented by j, and the differences in actual performance from expected results are represented by η_j. Algorithm 1 depicts the hybrid HHO-PSVM below.

Algorithm 1: Hybrid HHO-PSVM

```
Step 1: PSVM Classification
For each student assignment:
 Calculate score = Xt * z + a
 If score > 0:
 Classify as positive
 Else:
 Classify as negative
Step 2: HHO Optimization
For each student:
 Update learning position based on speed and engagement
 Update based on peer influence and collaboration
```

Adjust learning based on challenges and feedback
Step 3: Combine PSVM and HHO
Repeat:
Use HHO to improve PSVM classification
Minimize error between predicted and actual performance
Output: Optimized student performance

HHO is used to improve learning trajectories, while PSVM is used to categorize student assignments in the hybrid HHO-PSVM model. Initial categorization is provided by PSVM, and learning positions are repeatedly optimized by HHO using engagement, peer influence, and challenges. The model improves student performance by minimizing prediction mistakes.

RESULTS

Experiments using technology were carried out on a single 16 GB NVIDIA GTX1080TI GPU machine. Utilizing Python as the programming language, the framework development was accomplished in the PyTorch component. The findings demonstrate a significant improvement in student performance and metrics after combining HHO-PSVM optimization with traditional Chinese auspicious patterns. Accuracy, recall, precision, and F1-score measures all showed gains in the students' creativity, engagement, and cultural awareness. Overall, the results highlight how successful the suggested teaching strategies are in providing graphic design knowledge.

Comparison of Student Performance

According to this study, teaching computer graphic design with traditional Chinese auspicious patterns significantly improved student performance. Students demonstrated more creativity, engagement categories and cultural aesthetics. Students became more creative, involved, and culturally aware as a result of the addition of these cultural design components, which improved the learning process. Table 1 and figure 3 show the outcomes of the student's performance in pre and post pattern computational graphic learning through HHO-PSVM.

Table 1. Comparison of Outcomes of Students' Performance

Metrics	Pre-pattern (%)	Post-pattern (%)
Creativity	60	83
Engagement Categories	63	80
Cultural Aesthetics	65	85

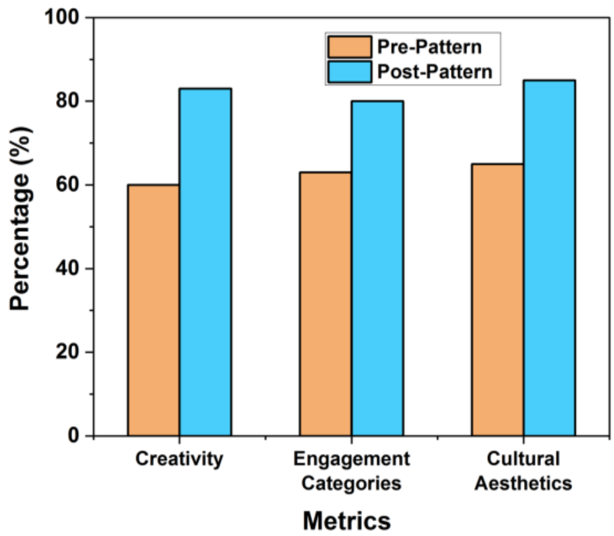

Figure 3. Comparison results of Students' Performance

According to this study, student performance has significantly improved in the proposed method HHO-PSVM. The average between pre and post pattern were taken as: 23 % more people were creative, 17 % more engaged, and 20 % more people understood cultural aesthetics. The teaching of graphic design was improved in terms of creativity, participation, and cultural awareness by using traditional Chinese auspicious motifs.

https://doi.org/10.56294/saludcyt2025540

Comparison of metrics optimization

Accuracy: the percentage of actual outcomes (true positives and true negatives) about all instances analyzed. It shows that the model is generally right.

Precision: the proportion of findings that are real positives to all displayed positives (true positives plus false positives). It gauges how accurately the model makes favorable predictions.

Recall: the percentage of actual positive outcomes to the total amount of true positives (false negatives plus true positives) is known as sensitivity. Recall measures the model's capacity to recognize all pertinent events.

F1-score: the one statistic that strikes a balance between accuracy and recall is the harmonic mean. In cases when one class can be more significant than the other, such as unbalanced datasets, it is very helpful. Table 2 and figure 4 depict the comparison outcomes of metrics in pre and post pattern computational graphic learning through HHO-PSVM.

Table 2. Comparison Outcomes of Metrics

Metrics	Pre-pattern (%)	Post-pattern (%)
Accuracy	65	89
Precision	63	87
Recall	68	90
F1-Score	64	88

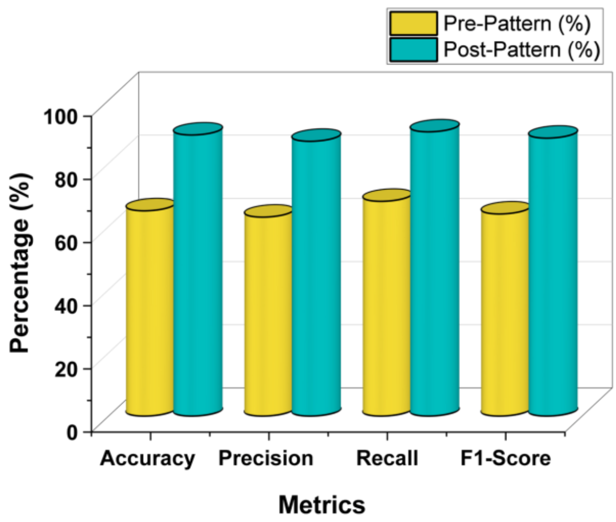

Figure 4. Comparison Outcomes of Metrics

In the proposed method, every performance parameter in this research showed improvements. The results of students in the HHO-PSVM showed an average improvement of 24 % in accuracy, 22 % in recall, 24 % in precision, and 24 % in F1 score.

Compare in with and without optimization

With the HHO-PSVM optimization, there are noticeable improvements in the performance measures. Following optimization, important domains including creativity engagement, engagement score, and aesthetic perception showed notable improvements. This demonstrates how optimization improves overall performance results. Table 3 and figure 5 demonstrate the outcomes of with and without optimization computational graphic learning through HHO-PSVM.

Table 3. Compare with and without optimization Outcomes

Metrics	Without optimization (%)	With HHO-PSVM optimization (%)
Engagement Score	68,0	85,5
Creativity Enhancement	71,0	87,2
Aesthetic Appreciation	72,5	88,9

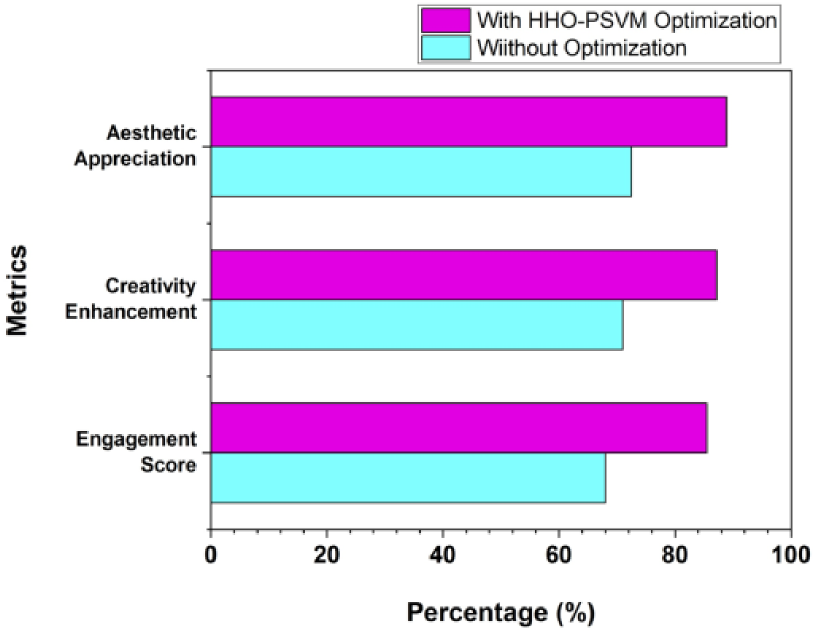

Figure 5. Compare with and without optimization Outcomes

The engagement score increased from 68,0 to 85,5, the creativity enhancement from 71,0 to 87,2, and the aesthetic appreciation from 72,5 to 88,9. These measures demonstrate significant increases with HHO-PSVM optimization. These outcomes demonstrate how well the optimization worked to improve customer happiness and experience generally.

DISCUSSION

This study highlights the effectiveness of the HHO-PSVM optimization method in enhancing student performance in graphic design education. However, some limitations must be considered. The sample size was quite small, which could limit the generalizability of the findings.(19) Additionally, the focus on traditional Chinese auspicious patterns might not be universally applicable to all cultural contexts, potentially restricting the method's broader applicability.(20) Implementation of HHO-PSVM in environments with varying technological access could also pose challenges. Despite these limitations, the proposed method demonstrated clear superiority in improving key performance metrics. The optimization led to significant improvements in creativity, engagement, and cultural aesthetics, as shown by the increase in pre- and post-pattern metrics. Moreover, performance measures such as accuracy, recall, precision, and F1-score all saw substantial improvements. Overall, HHO-PSVM outperformed non-optimized models, making it a promising approach for enhancing student outcomes in educational settings.

CONCLUSIONS

This study developed an innovative teaching model for computer graphic design by incorporating traditional Chinese auspicious patterns. These culturally significant patterns effectively enhanced students' understanding of visual aesthetics and cultural heritage. Additionally, the novel HHO-PSVM model demonstrated its capability to forecast student performance throughout the teaching process, highlighting its potential to support increased engagement and creativity in digital design education. To evaluate students' participation in instructional activities, this research gathered and examined student data. The results demonstrated how Chinese auspicious patterns in education boost students' involvement, inventiveness, and comprehension of cultural aesthetics. This advances the conversation between traditional art forms and the teaching of digital design more broadly. The possible computational complexity of the HHO-PSVM model with large data sets was a restriction that might affect its efficiency. The quantitative results of the measures, both pre and post pattern, were put into place. Recall increased from 68 % to 90 %, accuracy improved from 65 % to 89 %, precision reached from 63 % to 87 %, and the F1-score improved from 64 % to 88 %.To get more accurate performance forecasts, future research might investigate how to integrate other characteristics and optimize the system for scalability.

BIBLIOGRAPHIC REFERENCES

1. Shi M, Zhang C, Ting Y, Lin PH. Application of Auspicious Cultural in Metalworking Jewelry Design. InCross-Cultural Design. Applications in Health, Learning, Communication, and Creativity: 12th International Conference, CCD 2020, Held as Part of the 22nd HCI International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Part II 22 2020 (pp. 548-558). Springer International Publishing.

2. Xiao H. Optimized soft frame design of traditional printing and dyeing process in Xiangxi based on pattern mining and edge-driven scene understanding. Soft Computing. 2022 Dec;26(23):12997-3008.

3. Chen H, Xu H, Zhang Y, Jia L. The revitalization design of regional ethnic cultural capital in a sustainable perspective: the case of traditional Chinese garment Yunjian. Sustainability. 2022 Jul 1;14(13):8090.

4. Wang Y, Han Z. The enlightenment of the cultural elements of paper-cut to the creation of modern animation. In2020 International Conference on Computers, Information Processing and Advanced Education (CIPAE) 2020 Oct 16 (pp. 256-258). IEEE.

5. Zhou X, Liu Y, Xiaobo L, Zixuan P. Research on the application of Minnan architectural pattern elements in ceramics cultural creation under the background of big data. In2020 2nd International Conference on Information Technology and Computer Application (ITCA) 2020 Dec 18 (pp. 414-419). IEEE.

6. Zhang B, Romainoor NH. Research on artificial intelligence in new year prints: the application of the generated pop art style images on cultural and creative products. Applied Sciences. 2023 Jan 13;13(2):1082.

7. Liu E, Liu L, Wang J, Jin Q, Yao C, Ying F. Int-Papercut: An Intelligent Pattern Generation with Papercut Style Based on Convolutional Neural Network. In2020 15th IEEE Conference on Industrial Electronics and Applications (ICIEA) 2020 Nov 9 (pp. 59-67). IEEE.

8. Hu Z, Josef S, Min Q, Tan M, Cheng F. Visualizing the cultural landscape gene of traditional settlements in China: a semiotic perspective. Heritage Science. 2021 Dec;9:1-9.

9. Yu Q, Nagai Y. A new approach to teaching emotional design. Social Sciences. 2020 Nov 18;9(11):210.

10. Ji Y, Sun X, Dai X, Clark S, Liu Y, Fu T. Extraction and Reuse of Pattern Configuration for Personalized Customization of Cantonese Porcelain Based on Artificial Intelligence. InHuman-Computer Interaction. Human Values and Quality of Life: Thematic Area, HCI 2020, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Part III 22 2020 (pp. 276-293). Springer International Publishing.

11. Dan L, Baichen L. Research on Innovative Design of Digital Interactive Platform of Paper Engraving Process Based on Virtual Reality. In2020 International Conference on Innovation Design and Digital Technology (ICIDDT) 2020 Dec 5 (pp. 242-245). IEEE.

12. Zhang R, Zhao Y, Kong J, Cheng C, Liu X, Zhang C. Intelligent recognition method of decorative openwork windows with sustainable application for Suzhou traditional private gardens in China. Sustainability. 2021 Jul 28;13(15):8439.

13. Zhang J. Research on Innovation and Development of Chinese Traditional Textile Technology Duntou Blue Based on Design. InInternational Conference on Human-Computer Interaction 2022 Jun 26 (pp. 552-563). Cham: Springer Nature Switzerland.

14. Du Y, Jiang N. Exploring Innovative Models of Guizhou Miao Embroidery from a Digital Perspective. InInternational Conference on Human-Computer Interaction 2024 Jun 1 (pp. 30-47). Cham: Springer Nature Switzerland.

15. Wang Y, Agkathidis A, Crompton A. Parametrising historical Chinese courtyard-dwellings: An algorithmic design framework for the digital representation of Siheyuan iterations based on traditional design principles. Frontiers of Architectural Research. 2020 Dec 1;9(4):751-73.

16. Cao X, Hsu Y, Wu W. A Study on the Innovative Design of Fuzhou "FU" Cultural Tourism Products Based on Design Heuristics. InInternational Conference on Human-Computer Interaction 2023 Jul 9 (pp. 3-16). Cham: Springer Nature Switzerland.

17. Hao J, Pan C, Zhang E. Rich Media 2.0: A Methodology to Enhance Media Information Construction for Creating a Better User Experience. InDesign, User Experience, and Usability. Interaction Design: 9th International Conference, DUXU 2020, Held as Part of the 22nd HCI International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Part I 22 2020 (pp. 113-129). Springer International Publishing.

18. Ou Yang L, Li H. Translation and Visual Presentation of Cultural Symbols of ChaoshanMid Autumn Festival Sacrifice. InInternational Conference on Human-Computer Interaction 2024 Jun 7 (pp. 292-302). Cham: Springer Nature Switzerland.

19. Zhu D, Liu G. Deep Neural Network Model-Assisted Reconstruction and Optimization of Chinese Characters in Product Packaging Graphic Patterns and Visual Styling Design. Scientific Programming. 2022;2022(1):1219802.

20. Zhang X, Dong Y. Research on the graphic reconstruction of traditional auspicious patterns in contemporary art design. Highlights in Art and Design. 2023 Mar 29;2(2):73-9.

FINANCING
No financing.

CONFLICT OF INTEREST
The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION
Software: Mengze Yuan.
Drafting - original draft: Mengze Yuan, Surendheran Kaliyaperuma.
Writing - proofreading and editing: Surendheran Kaliyaperuma.