The Relationship between Attitudes towards Generative AI Tools and Learning Engagement among Students Majoring in Cultural Heritage Conservation at Shandong University of Arts in China

Jiteng Li [1*] and Beibei Chen [2]
[1] Master of Educational Administration, Stamford International University, Thailand
[2] Ph.D., Lecturer, Stamford International University, Thailand
[*] Corresponding author: 1458873817@qq.com

Abstract: This study took students from the cultural heritage conservation major at Shandong University of Arts as research subjects. This research employed the questionnaire survey method as the primary research approach, integrating statistical techniques including descriptive statistical analysis, independent-samples t-tests, one-way analysis of variance (ANOVA), and Pearson correlation analysis to conduct a systematic analysis of the data. During the research process, through organizing and statistically analyzing the valid questionnaire data, we performed frequency analysis on the overall levels of students' attitudes towards generative AI tools and their learning engagement. We also examined the correlation between attitudes towards generative AI tools and learning engagement. The research findings indicated that students from the cultural heritage conservation major at Shandong University of Arts hold relatively positive attitudes towards generative AI tools and generally exhibit high levels of learning engagement. In terms of differences, students from different grade levels, with varying academic performances, and with different study durations show significant differences in their attitudes towards generative AI tools. Similarly, students with different genders, grade levels, academic performances, and study durations also demonstrate significant differences in their levels of learning engagement, while the family background variable only shows significant differences in certain dimensions. In the correlation analysis, a notably positive correlation is identified between attitudes toward generative AI tools and students' learning engagement, with each attitude dimension demonstrating strong correlations with emotional engagement, cognitive engagement, and behavioral engagement. This study puts forward targeted suggestions including staged governance mechanisms, standardized usage norms, precise learning engagement promotion and improved teachers' generative AI literacy to advance the rational application of generative AI in cultural relic restoration education.

Keywords: Attitudes towards Generative AI Tools, Learning engagement, Major Cultural Heritage Conservation.

1. Introduction

This section outlines the research background from international, domestic, and local perspectives (Ferguson et al., 2022). Internationally, as a transformative technological force, AI is increasingly integrated into education, cation, with policies and practices from the U.S., UK, Japan and UNESCO supporting its role in advancing educational equity, personalized learning, and applications in arts and humanities education—including cultural relic restoration—where studies show improved student participation and course completion. Domestically, China has elevated AI to a national strategy, with policies driving its deep integration into higher education; AI has been widely applied in art education and cultural relic restoration teaching across Chinese universities, significantly boosting students' learning engagement and promoting digital and intelligent reform in higher art education. Locally, Shandong University of Arts, a pioneer in cultural heritage conservation education, has begun adopting AI tools for teaching innovation in response to national strategies, yet faces challenges including uneven student AI literacy, mixed attitudes toward AI, and insufficient empirical evidence on AI's impact on learning engagement. Against this layered background, this

study focuses on students majoring in cultural heritage conservation at the university to examine the relationship between their attitudes toward generative AI and learning engagement, seeking to provide theoretical support and practical suggestions for teaching optimization (Bagherimajd & Khajedad, 2025).

Research Questions

(1) What is the current status of the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools?

(2) What is the current status of the learning engagement of students majoring in cultural heritage conservation at Shandong University of Arts?

(3) Are there differences in the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools under different background variables?

(4) Are there differences in the learning engagement of students majoring in cultural heritage conservation at Shandong University of Arts under different background variables?

(5) What is the correlation between the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools and their learning engagement?

Research Objectives

(1) To understand the current status of the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools.

(2) To understand the current status of the learning engagement of students majoring in cultural heritage conservation at Shandong University of Arts.

(3) To analyze the differences in the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools under different background variables.

(4) To analyze the differences in the learning engagement of students majoring in cultural heritage conservation at Shandong University of Arts under different background variables.

(5) To explore the correlation between the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools and their learning engagement.

Research Hypotheses

H1: Students majoring in cultural heritage conservation at Shandong University of Arts with different background variables show significant differences in their attitudes towards generative AI tools.

H1-1: Students of different genders majoring in cultural heritage conservation at Shandong University of Arts show significant differences in their attitudes towards generative AI tools.

H1-2: Students of different grades majoring in cultural heritage conservation at Shandong University of Arts show significant differences in their attitudes towards generative AI tools.

H1-3: Students with different academic performances majoring in cultural heritage conservation at Shandong University of Arts show significant differences in their attitudes towards generative AI tools.

H1-4: Students from different family backgrounds majoring in cultural heritage conservation at Shandong University of Arts show significant differences in their attitudes towards generative AI tools.

H1-5: Students with different learning durations majoring in cultural heritage conservation at Shandong University of Arts show significant differences in their attitudes towards generative AI tools.

H2: Students with different background variables show significant differences in their learning engagement.

H2-1: Students of different genders show significant differences in their learning engagement.

H2-2: Students of different grades show significant differences in their learning engagement.

H2-3: Students with different academic performances show significant differences in their

learning engagement.

H2-4: Students from different family backgrounds show significant differences in their learning engagement.

H2-5: Students with different learning durations show significant differences in their learning engagement.

H3: There is a positive correlation between the attitudes of students majoring in cultural heritage conservation at Shandong University of Arts towards generative AI tools and their learning engagement.

CONCEPTUAL FRAMEWORK

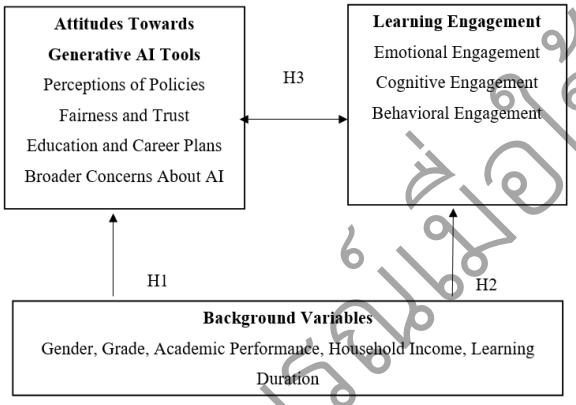

Figure. 1: Research Conceptual Framework

LITERATURE REVIEW

Technology Acceptance Model

This section introduces the Technology Acceptance Model (TAM) proposed by Davis in 1986, which explains users' technology adoption behavior through perceived usefulness and perceived ease of use that shape attitude, behavioral intention, and actual usage; widely applied in educational technology research including online learning, VR, and AI-assisted teaching, TAM has been expanded to TAM2 and TAM3 with additional variables such as social influence and self-efficacy, yet it also has limitations including overemphasis on cognitive factors, insufficient consideration of motivation and emotion, weak explanatory power in emotion-oriented art education, and a static structure that fails to reflect dynamic learner adaptation or complex classroom influences, leading recent studies to integrate it with social constructivism and self-determination theory. As a classic and practical framework, TAM remains valuable for measuring students' attitudes toward generative AI tools, and this study therefore applies TAM to analyze how cultural heritage conservation students at Shandong University of Arts accept AI technology and its potential influence on their learning engagement (Matiza, 2019).

Learning Engagement Theory

Learning Engagement Theory, a core theory in educational psychology, highlights that students' active participation determines effective learning; Fredricks et al. (2004) divided it into behavioral, emotional, and cognitive engagement, which are interrelated and widely used in higher education to assess teaching quality and the effects of educational technologies like AI-assisted teaching, though the theory faces limitations such as ambiguous boundaries between the three dimensions, overlapping measurements, overfocus on subjective experience, and insufficient adaptability for art education, leading recent studies to adopt a situational interaction perspective emphasizing joint influences from individuals, technology, and environment. Nonetheless, the theory remains valuable for explaining learning behaviors and evaluating technology interventions, offering a structured framework for this study to measure students' learning engagement across the three dimensions and examine its correlation with their attitudes toward generative AI tools, connecting theoretical foundations with practical research (Irén, 2024).

Generative Ai Tools

Students' attitudes towards generative AI tools are a multi-dimensional, dynamic, and context-dependent concept, reflecting their operational behaviors, cognitive understanding, emotional experiences, and ethical stances regarding AI in learning, as well as its connection to their career development (Zhang et al., 2021). Relevant research has shifted from theoretical discussions to empirical validations, affirming AI's role in improving learning efficiency and optimizing teaching processes while noting challenges such as technological anxiety, insufficient literacy, and superficial application; in the Chinese context, AI has been initially applied

in cultural heritage conservation education in universities, showing potential in digital modeling and intelligent restoration, yet research on students' perspectives and its impact on learning remains insufficient (Blauth et al., 2022). Regarding measurement, existing tools are mostly based on the Technology Acceptance Model and multi-dimensional frameworks, but they have limitations such as inconsistent dimensional divisions and poor professional adaptability; thus, this study constructs a suitable measurement tool for art students based on existing scales, incorporating dimensions like understanding and cognition, skills and literacy, and hopes and expectations, and references a validated scale to comprehensively measure students' attitudes towards generative AI tools (Kaur et al., 2020).

Learning Engagement

This section systematically elaborates on the concept, related research, and measurement of learning engagement. Initially proposed by Astin and later refined into a three-dimensional framework (behavioral, emotional, and cognitive engagement) by Fredricks et al., learning engagement refers to students' psychological and behavioral characteristics during learning and has become a key indicator in higher education research; with the application of AI, its connotation has expanded to include technology interaction, though controversies remain regarding conceptual ambiguity and overlapping dimensions, especially in art-related fields. Internationally, extensive research has validated the positive effects of educational technology on engagement, yet studies targeting art and cultural heritage conservation students are limited, as their engagement is situational, subjective, and poorly captured by traditional task-oriented measures (Adegoriola et al., 2021). In the Chinese context, research on cultural relic restoration students' learning engagement is still in the exploratory stage, lacking discipline-specific scales and empirical evidence, while AI-assisted teaching has shown potential to boost interest but also brings challenges such as technological anxiety. Regarding measurement, the widely used three-dimensional structure and scales like USEI provide a foundation, but existing tools face issues of inconsistent standards, subjective bias, and insufficient adaptability for art majors; therefore, this study adopts the classic behavioral-emotional-cognitive framework to measure learning engagement and explore its new characteristics under the influence of generative AI attitudes (Ahmed et al., 2021).

Research on the Relationship Between Two Variables

The relationship between students' attitudes towards generative AI tools and their learning engagement is a cross-disciplinary research direction involving art education, educational technology, and cultural heritage conservation, with existing research mainly focusing on STEM disciplines where AI enhances behavioral and cognitive engagement through interaction, feedback, and simulation; in cultural heritage conservation teaching, AI serves as a means of pedagogical transformation, with preliminary cases showing it can improve students' situational understanding and cognitive engagement, though challenges like technological anxiety, operational difficulties, and formalistic use may undermine its positive effects, and empirical research in this field remains scarce, lacking systematic quantitative measurement, theoretical support, and a student-centered perspective (Kelly et al., 2023). Shandong University of Arts, a regional art university with a solid foundation in cultural heritage conservation education and a mature professional training system, has no publicly available systematic research or in-depth application of AI in the cultural heritage conservation major's teaching, despite having AI-related teaching reform projects in other art majors, making research in this field at the university valuable for filling the existing research gap and providing support for the intelligent transformation of art education (Wang et al., 2024).

2. Materials and Methods

This study adopts a quantitative research design to investigate the current status of cultural heritage conservation students' attitudes towards generative AI tools and their learning engagement

at Shandong University of Arts, as well as the impact of different demographic backgrounds on these variables; the research process includes conducting a literature review to lay a theoretical foundation, designing a questionnaire based on relevant scales for the two core variables, distributing and collecting online questionnaires through convenience sampling, eliminating invalid ones, organizing valid data for descriptive statistics, and using SPSS for reliability, validity, and difference analysis, finally analyzing the research results to draw conclusions and put forward relevant recommendations and strategies. The research subjects of this study are focused on all 302 students enrolled in the cultural heritage conservation major at Shandong University of Arts. This study utilized stratified sampling to select the sample. Based on the sample size determination table proposed by Krejcie and Morgan (1970), under the conditions of a 95% confidence level and a ±5% margin of error, the appropriate sample size is 170 individuals.

Based on literature review and relevant research analysis, this study's questionnaire is designed using Tang et al.'s (2025) "Students' Attitudes towards Generative AI Tools" scale and Prananto's (2025) "Learning Engagement" scale, consisting of two parts: the first part collects respondents' basic demographic information (including gender, grade, academic performance, family background, and study duration), and the second part adopts both scales in a 5-point Likert format (1 = strongly disagree to 5 = strongly agree), requiring participants to select options that match their views, with responses scored accordingly.

Reliability and validity analyses were conducted for the two scales used in this study: for Tang et al.'s (2025) "Students' Attitudes towards Generative AI Tools" scale (4 dimensions, 13 items), Cronbach's α coefficients for each dimension ranged from 0.71 to 0.81, indicating acceptable to high internal consistency; for Prananto's (2025) University Student Engagement Inventory (3 dimensions), Cronbach's α coefficients for each dimension were 0.861 to 0.881, with an overall α of 0.893, showing good reliability. For validity, the KMO value was 0.73 and Bartlett's test was significant ($p < .001$) for the AI attitude scale, with its four-factor model explaining 47.3% of total variance and good model fit; for the engagement inventory, KMO was 0.855 ($p < .001$), and factor analysis yielded three dimensions explaining 62.33% of total variance, demonstrating good validity for both scales.

3. Results and Discussion

3.1 Demographic Analysis of the Respondents

A total of 170 valid questionnaires were collected, with 47.06% male and 52.94% female students, showing a relatively balanced gender distribution. Grade distribution was also well-proportioned, with freshmen 25.29%, sophomores 21.76%, juniors 27.06%, and seniors 25.88%. Academic performance varied notably, with 25.29% excellent, 18.82% good, 22.35% pass, and 33.53% fail. Family monthly income was evenly distributed across four brackets, and daily learning time was spread across less than 3 hours, 3–5 hours, 6–8 hours, and over 8 hours, ensuring broad coverage of different student groups and providing a reliable sample for further analysis.

Table. 1: Demographic Information of the Participants (N = 170)

Background	Category	N	%
Gender	Male	80	47.06
	Female	90	52.94
Grade	Freshmen	43	25.29
	Sophomore	37	21.76
	Junior	46	27.06
	Senior	44	25.88
Academic Performance	Excellent	43	25.29
	Good	32	18.82
	Pass	38	22.35
	Fail	57	33.53
Household Income	Below 5,000 yuan	39	22.94
	5001-8000 yuan	52	30.59
	8001-12000 yuan	37	21.76
	Above 12,000 yuan	42	24.71
Learning Duration	Below 3 hours	52	30.59
	3 – 5 hours	34	20.00
	6 – 8 hours	37	21.76
	Above 8 hours	47	27.65
Total		170	100.0

3.2 Hypothesis Testing

Results show that students majoring in cultural heritage conservation at Shandong University of Arts hold highly positive attitudes toward generative AI tools, with an overall mean score of 4.28 (SD = 0.655). Among the four

dimensions, “broader concerns about AI” scored the highest (M = 4.29, SD = 0.673), followed by “education and career plans” (M = 4.28, SD = 0.671), while “perceptions of policies” and “fairness and trust” both reached 4.27 (SD = 0.716 and 0.708 respectively). All dimension means exceeded 4.26 with small standard deviations, reflecting generally consistent, concentrated attitudes, as students not only recognize AI’s value in learning and professional development but also pay attention to its social and industrial impacts, while remaining cautious about fairness, academic integrity, and result reliability.

Table. 2: Current Status of Attitudes towards Generative AI Tools among Students in the Cultural Heritage Conservation

Dimension	N	M	SD	Interpretation
Perceptions of Policies	170	4.27	0.716	High
Fairness and Trust	170	4.27	0.708	High
Education and Career Plans	170	4.28	0.671	High
Broader Concerns about AI	170	4.29	0.673	High
Attitudes towards Generative AI Tools	170	4.28	0.655	High

The overall learning engagement level of cultural heritage conservation students at Shandong University of Arts is very high, with an overall mean score of 4.79 (SD = 0.392). Specifically, the mean scores of the three dimensions are all around 4.8: emotional engagement (M = 4.79, SD = 0.384), cognitive engagement (M = 4.78, SD = 0.431), and behavioral engagement (M = 4.79, SD = 0.412), all falling into the "Very High" range. The small standard deviations indicate that students' learning engagement is relatively consistent across individuals, reflecting their strong learning interest, active thinking, and proactive participation in various learning activities related to cultural heritage conservation.

Table. 3: Learning Engagement Status of Cultural Heritage Conservation

Dimension	N	M	SD	Interpretation
Emotional Engagement	170	4.79	0.384	High
Cognitive Engagement	170	4.78	0.431	High
Behavioral Engagement	170	4.79	0.412	High
Learning Engagement	170	4.79	0.392	High

Statistical analyses were conducted on 170 valid questionnaires to test group differences and correlations regarding students’ attitudes toward generative AI tools and learning engagement. Significant differences in attitudes toward generative AI tools were found across grade, academic performance, family income, and daily study duration, with upper-grade students, higher-performing students, those from higher-income families, and students with longer study durations showing more positive attitudes; gender differences were only significant in the education and career plans dimension, not in overall attitudes. Significant differences in learning engagement emerged across gender, grade, academic performance, and study duration, with female students, upper-grade students, higher-performing students, and those with longer study durations demonstrating higher engagement, while family income only affected emotional engagement but not overall learning engagement. Pearson correlation analysis revealed a significant positive correlation between students’ attitudes toward generative AI tools and their learning engagement at the 0.01 level, with the overall correlation coefficient reaching 0.801, indicating that more positive AI attitudes correspond to higher levels of emotional, cognitive, and behavioral engagement.

3.3 Discussion

Students majoring in cultural heritage conservation at Shandong University of Arts demonstrate a generally high and positive attitude toward generative AI tools, reflected in their policy awareness, rational understanding of ethical issues, and recognition of academic and career value. Their attitudes are comprehensive, integrating cognition, evaluation, and future expectations. This finding aligns with studies showing that students are more likely to accept technologies that effectively support learning and development (Chung et al., 2024; Wang et al., 2024).

The overall level of learning engagement

among students is relatively high across emotional, cognitive, and behavioral dimensions, indicating strong motivation, deep learning strategies, and stable participation. This is closely related to the practice-oriented nature of the major. The findings support the multidimensional structure of learning engagement (Yu et al., 2023) and reflect students' strong professional identity and sustained involvement.

Students' attitudes toward generative AI tools differ significantly by grade, academic performance, and learning duration, while gender and family background show relatively limited influence. Senior students, high achievers, and those with longer learning time tend to hold more positive attitudes, highlighting the roles of learning experience and self-efficacy. This is consistent with recent research emphasizing the influence of developmental stage and learning experience on technology acceptance (Chung et al., 2024; Lo, 2023).

Learning engagement varies significantly across gender, grade, academic performance, and learning duration, with higher levels observed among female students, senior students, and high-performing students. Family background mainly affects emotional engagement but has limited impact overall. These findings support the view that learning engagement is a dynamic process shaped by individual development and learning context (Marder et al., 2023).

There is a significant positive correlation between students' attitudes toward generative AI tools and their learning engagement, indicating that more positive attitudes are associated with higher emotional, cognitive, and behavioral involvement. This supports the integration of technology acceptance and learning engagement perspectives (Yu et al., 2023) and suggests that perceived usefulness and trust in AI tools enhance motivation and deeper learning. The findings highlight the importance of fostering rational and positive attitudes toward AI in higher education.

4. Conclusion

Based on frequency analysis, group difference comparisons, and correlation tests among 170 cultural heritage conservation students at Shandong University of Arts, this study concludes that respondents hold highly positive attitudes toward generative AI tools (overall $M = 4.27$) and demonstrate a very high level of learning engagement (overall $M = 4.79$) with consistent scores across all subdimensions. Group comparisons reveal significant differences in AI attitudes by grade, academic performance, family income, and learning duration, while gender only affects the education and career dimension; similarly, learning engagement differs significantly by gender, grade, academic performance, and learning duration, with family income influencing only emotional engagement but not overall engagement. Pearson correlation analysis confirms a strong positive relationship between AI attitudes and learning engagement ($r = 0.801$, $p < 0.01$), with all attitude subdimensions showing significant positive correlations with learning engagement and its components at the 0.01 significance level.

5. Recommendation

To effectively promote the standardized and rational application of generative AI in cultural relic restoration education, this study proposes four practical recommendations: establishing a hierarchical and categorized governance and support mechanism that adapts generative AI teaching guidance to students' progressive learning stages across three years of professional training; improving relevant usage norms and academic integrity management systems to clarify application boundaries, standardize auxiliary learning behaviors, and ensure fair technological access for all students; implementing precision-oriented strategies targeting low-engagement student groups to guide proper generative AI use and enhance deep learning engagement without replacing hands-on practical training; and strengthening the generative AI literacy and governance capacity of teachers and teaching managers, so as to build a regulated, sustainable generative AI application environment that better supports high-quality talent cultivation in cultural relic restoration.

6. Future Research

Future research can expand the research scope to students majoring in other art-related fields, adopt mixed-methods combining quantitative questionnaire surveys with qualitative interviews, conduct comparative analyses among different universities and regions, and further explore long-term dynamic changes in students' attitudes toward generative AI and learning engagement under diverse educational environments.

References

Adegoriola, M. I., Lai, J. H. K., Chan, E. H., & Darko, A. (2021). Heritage building maintenance management (HBMM): A bibliometric-qualitative analysis of literature. *Journal of Building Engineering*, *42*(67), 102416.

Ahmed, S. A., Othman, B. J., Gardi, B., & Sabir, B. Y. (2021). Students' attitudes towards learning English in the Kurdistan region of Iraq. *International Journal of English Literature and Social Sciences*, *6*(3), 072–087. https://doi.org/10.22161/ijels.63.11

Bagherimajd, kamran, & khajedad, K. (2025). Designing a model of sustainable education based on artificial intelligence in higher education. *Computers and Education: Artificial Intelligence*, *9*(9), 100439.

Blauth, T. F., Gstrein, O. J., & Zwitter, A. (2022). Artificial intelligence crime: An overview of malicious use and abuse of AI. *IEEE Access*, *10*(77), 77110–77122. https://doi.org/10.1109/access.2022.3191790

Davis, F. D. (1986). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Ferguson, C., van den Broek, E. L., & van Oostendorp, H. (2022). AI-Induced guidance: Preserving the optimal zone of proximal development. *Computers and Education: Artificial Intelligence*, *122*(22), 100089.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Irén, A. (2024). Re-Evaluating components of classical educational theories in AI-enhanced learning: An empirical study on student engagement. *Education Sciences*, *14*(9), 974–974. https://doi.org/10.3390/educsci14090974

Kaur, S., Singla, J., & Nkenyereye, L. (2020). Medical diagnostic systems using artificial intelligence (AI) algorithms: Principles and perspectives. *IEEE Access*, *8*(2169-3536), 228049–228069. https://doi.org/10.1109/access.2020.3042273

Kelly, A., Sullivan, M., & Strampel, K. (2023). Generative artificial intelligence: University student awareness, experience, and confidence in use across disciplines. *Journal of University Teaching & Learning Practice*, *20*(6), 78–90.

Matiza, T. (2019). A conceptual model for telemedicine adoption: An examination of technology acceptance model. *International Journal of Recent Technology and Engineering*, *8*(2), 1286–1288.

Prananto, K. (2025). Psychometric Test of the University Student Engagement Inventory (USEI) in Indonesian Version: Validity and Reliability in Students in Indonesia. *Humanities, 9*(1), 41–56.

Tang, X., Chen, S., Cheng, Y., Chawla, N. V., Metoyer, R., & Ambrose, G. A. (2025). Understanding student attitudes of Gen AI tools in higher education: Scale development and evaluation. *Association for the Advancement of Artificial Intelligence 3*(9),56-62.

Wang, C., Wang, H., Li, Y., Dai, J., Gu, X., & Yu, T. (2024). Factors influencing university students' behavioral intention to use generative artificial intelligence: Integrating the theory of planned behavior and AI literacy. *International Journal of Human-Computer Interaction*, *7*(78), 1–23.

Zhang, Z., Citardi, D., Wang, D., Genc, Y., Shan, J., & Fan, X. (2021). Patients' perceptions of using artificial intelligence (ai)-based technology to comprehend radiology imaging data. *Health Informatics Journal*, *27*(2), 146045822110112.

Authors' Biography:

The researcher currently studies in MEA Program, Graduate School of Stamford International University, her research interest is in the fields of educational administration, school management and educational leadership.