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A picture book-centered medical humanities course at a Chinese medical university: a pilot pre–post study

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Abstract

Background

Arts-based approaches are increasingly being integrated into medical humanities education, but quantitative evidence on picture book-based, student-generated learning remains limited. This study evaluated a picture book-centered aesthetic education course based on a three-dimensional integrated teaching model among undergraduate students in medical education.

Methods

We conducted a single-arm pre–post study in an elective course at a medical university from September to November 2024. Participants were recruited by convenience sampling from students enrolled in the course. The intervention was structured around three components: aesthetic perception, emotional resonance, and creative practice. Outcomes were assessed immediately before the course and immediately after course completion using the College Students' Aesthetic Education Learning Attitude Scale and the Chinese version of the Williams Prefer Measurement Forms. Course performance was summarized descriptively, and pre–post differences were analyzed using paired-sample t tests. In addition, The Benjamini-Hochberg False Discovery Rate (BH-FDR) procedure was employed to conduct a sensitivity analysis of the results.

Results

Of 80 students enrolled in the course, 68 met the eligibility criteria and 61 completed both pre-course and post-course assessments and were included in the analysis. The overall course score was 85.11 ± 7.99, including a formative assessment score of 76.90 ± 25.40 and a final picture book project score of 88.22 ± 2.88. After the course, mean item scores increased for both aesthetic learning attitudes and creativity tendency. Significant improvements were observed in the cognitive and affective dimensions and total score of aesthetic learning attitudes, and in risk-taking, challenge, and the total score of creativity tendency. In exploratory analyses with BH-FDR adjustment, significant improvements remained in the cognitive and affective dimensions of aesthetic learning attitude, and in the risk-taking and challenge dimensions of creativity tendency.

Conclusions

This pilot single-arm pre–post study suggests that a picture book-centered medical humanities course is feasible within an elective format and may be associated with short-term improvements in self-reported aesthetic learning attitudes and selected creativity-related dispositions. Because the study used an

uncontrolled design and self-report outcomes, causal inferences are limited. Future controlled studies with longitudinal follow-up and performance-based outcomes are needed.

Trial registration

Trial registration number: Not applicable.

1. Background

Curriculum design in contemporary medical schools still prioritizes professional knowledge and clinical skills[1], while competencies essential to patient-centered care—such as empathy, cultural sensitivity, careful observation, tolerance of uncertainty, and professional resilience—may receive less systematic attention[2]. Over the past three decades, interdisciplinary integration has gained increasing recognition in medical education as a way to address these gaps and to move beyond a solely technology-centered model of training[1]. In 2018, a consensus report from the U.S. National Academies of Sciences, Engineering, and Medicine highlighted the value of integrating the arts and humanities into higher education, including medicine, and linked such integration to outcomes such as compassion, resilience, and teamwork[3]. This direction is also consistent with current educational policy in China emphasizing the cultivation of well-rounded, humanistically grounded professionals[4].

Aesthetic education can promote aesthetic values, aesthetic competence, and creative thinking through engagement with art, nature, society, and science, and has increasingly been discussed as a meaningful component of humanistic education[5]. In medical education, arts-based teaching has been delivered through diverse media, including literature, music, and visual arts[6–10]. Previous studies suggest that such approaches may enhance a range of learner outcomes[11–15]. However, important gaps remain. Existing research has paid relatively limited attention to the cultivation of curiosity and creativity in medical training[16, 17], and evidence is still insufficient regarding how arts-based interventions influence learners' attitudes, behaviors, and broader educational development[18]. In addition, as DiCarlo argued, the educational value of a curriculum depends not only on what is taught, but also on how it is taught[19]. Against this background, the Three-Dimensional Integrated Teaching Model offers a structured framework for course design by linking three educational aims: aesthetic perception, emotional resonance, and creative practice. Guided by this framework, we developed a picture book-centered course: *Feeling Art, Creating Beauty—Picture Book Art Aesthetic Education*, to support humanistic and creative development in undergraduate medical education.

Picture books are multimodal narrative forms in which images and concise text work together to communicate stories, meanings, and experiences. Because they combine visual expression with narrative structure, they may be particularly suitable for educational settings that aim to connect observation, interpretation, emotional engagement, and reflection. Visual arts have been used in medical training not only to support observation and interpretation, but also to encourage emotional expression, communication, and reflective thinking[20, 21]. Within this context, picture books may help stimulate

learning engagement, strengthen close observation, and promote discussion grounded in image-based meaning making[22]. They may also provide a reflective and creative medium through which students can explore patient experiences and humanistic themes more actively[23]. Building on this rationale, we designed a picture book-centered aesthetic education course that emphasized student-generated outputs, with students creating their own picture books individually or in teams.

Despite growing interest in arts- and humanities-based approaches in medical education, quantitative evidence remains limited regarding whether student-generated, output-oriented aesthetic tasks can influence learners' aesthetic learning attitudes and creativity-related dispositions in undergraduate medical training. Although picture books may offer a feasible medium for integrating visual interpretation, narrative reflection, and creative expression, their systematic use in medical education and their quantitative evaluation remain scarce. Therefore, this study implemented a picture book-centered aesthetic education course guided by a three-dimensional integrated teaching model and used a single-arm pre-post design to evaluate its associations with students' aesthetic learning attitudes and creativity tendency.

2. Methods

2.1 Study design and setting

This study was a single-arm pre-post study conducted in an elective course at a medical university from September to November 2024, which aimed to evaluate the feasibility of a picture book-centered aesthetic education course guided by a three-dimensional integrated teaching model and to examine its associations with students' aesthetic learning attitudes and creativity tendency. Outcomes were assessed immediately before the first class session and immediately after course completion.

2.2 Participants

Participants were recruited by convenience sampling from students enrolled in the elective course. Eligible participants were full-time undergraduate students aged 18 years or older who provided written informed consent. Exclusion criteria were prior participation in a similar aesthetics-related course within the previous two years and any condition that prevented completion of the course or study assessments. Participants were excluded from the final analysis if they attended less than 80% of the course sessions or withdrew before completing the post-course assessment. Detailed eligibility criteria are provided in Supplementary Table S1.

A total of 80 students enrolled in the course. Twelve were excluded before baseline because they had taken a similar course within the previous two years, leaving 68 eligible participants. Of these, 61 completed both the pre-course and post-course assessments and were included in the complete-case analysis. Seven participants did not complete the post-course assessment because of insufficient attendance or withdrawal. Attrition analysis was not performed because baseline data were incomplete for non-completers.

As this was an exploratory evaluation of a single elective-course cohort, no a priori sample size calculation was performed.

2.3 Course objectives and intervention

The intervention was an elective, 1-credit, 18-hour picture book-centered aesthetic education course entitled "*Feeling Art, Creating Beauty—Picture Book Art Aesthetic Education*", designed as an arts-based medical humanities course for undergraduate students. The course was guided by a three-dimensional integrated teaching model and developed with reference to the revised Bloom's Taxonomy of Educational Objectives to align learning outcomes across cognitive, affective, and creative practice domains[24]. The course aimed to support students' aesthetic engagement, reflective learning, and creative output relevant to medical humanities education. Detailed learning objectives are provided in Supplementary Table S2.

The intervention was also informed by Herbart's Aesthetic Education Theory[25] and Amabile's Componential Theory of Creativity[26]. It was organized around three interrelated components: aesthetic perception, emotional resonance, and creative practice. Aesthetic perception focused on multisensory engagement with picture books through visual and auditory analysis. Emotional resonance emphasized guided reflection, discussion, and sharing. Creative practice centered on student-generated picture book production, completed individually or in teams.

The course was delivered in six modular sessions covering theory, practice, and reflection. Teaching activities were implemented through three phases: pre-class online preparation, in-class multimodal analysis and performance-based activities, and post-class reflection culminating in the creation of an original picture book project under instructor guidance. The course structure is summarized in **Table 1** and the detailed session schedule and intervention components are presented in Supplementary Table S3 and Supplementary Table S4.

Table 1 The course structure

Theoretical Guidance	
• Bloom's Taxonomy of Educational Objectives • Herbart's Aesthetic Education Theory • Amabile's Componential Theory of Creativity	
Teaching Objectives	
• Master picture book creation process and Grasp integration approaches of picture books and music • Enhance self-healing and emotional resonance and Establish correct life values • Achieve collaborative development of aesthetic ability and creativity	
Teaching Methods	**Teaching Content**
• Heuristic and situational teaching models • Project-based and case teaching • Interactive and cooperative learning	• Integrating Narrative Picture Books & AI Technology • Incorporating Music and Interactive Elements • Exploring Technology-Picture Book Synergies • Fostering Artistic Aesthetics & Innovative Thinking

2.4 Course assessment

Course performance was evaluated using a combination of formative and summative assessment. Formative assessment accounted for 30% of the final course grade and included attendance (10%), in-class participation (10%), and picture book musical performance (10%). Summative assessment accounted for 70% and consisted of the creation of an original picture book project designed to evaluate students' integrated knowledge, skills, and affective engagement. The overall course score, formative assessment score, and final project score were summarized descriptively.

2.5 Outcome measures

College students' aesthetic education learning attitude

The study employed Li Dawen's Contemporary College Students' Aesthetic Learning Attitude Scale[27] to evaluate the learning enthusiasm, administering it before and after the course. The scale contains 14 items across three dimensions: cognitive (8 items), affective (3 items), and behavioral (3 items). Items are rated on a 5-point Likert scale ranging from -2 (strongly disagree) to +2 (strongly agree), with higher scores indicating more positive aesthetic learning attitudes. The reported Cronbach's α of the scale was 0.941. Standardized instructions were used, and questionnaires were distributed and collected on site before and after the course. For analysis, mean item scores were calculated for each dimension and for the overall scale.

2.5.1 Creativity tendency

This study used the Chinese version of the Williams Prefer Measurement Forms[28] to assess the "Creative Practice" dimension, administered pre-course and post-course. The instrument contains 50 items across four dimensions: risk-taking (11 items), curiosity (14 items), imagination (13 items), and challenge (12 items). Items are rated on a 3-point Likert scale, and eight items are reverse scored. Higher scores indicate stronger creativity tendency. The reported Cronbach's α of the Chinese version was 0.877. The scale was administered immediately before and after the course under standardized conditions. For analysis, mean item scores were calculated for each dimension and for the overall scale after reverse scoring.

2.6 Statistical analysis

Data were analyzed using R software. Categorical variables are presented as frequencies and percentages, and continuous variables as mean ± standard deviation (SD). Pre-course and post-course mean item scores were compared using paired-sample t tests. Mean differences (MD), 95% confidence intervals (CI) for paired samples were reported. Because multiple subscale comparisons were conducted, exploratory subscale analyses were adjusted using the Benjamini–Hochberg false discovery rate (BH-FDR) procedure. Adjustment was performed separately within two prespecified outcome families: the aesthetic learning attitude family (cognitive, affective, and behavioral) and the creativity tendency family (risk-taking, curiosity, imagination, and challenge). All tests were two-sided. For the two primary outcomes, $p < 0.05$ was considered statistically significant; for exploratory subscale analyses, statistical significance was interpreted based on the BH-FDR-adjusted q values. Analyses were conducted on participants with complete pre-course and post-course data.

2.7 Ethical approval

This study was conducted in accordance with the Declaration of Helsinki and its later amendments. Ethical approval was obtained from the Medical Ethics Committee of Guangzhou Medical University (No. 202411021). Written informed consent was obtained from all participants before data collection. Students were explicitly informed that participation in the research components of the course (including completion of the pre- and post-course questionnaires) was entirely voluntary and that their decision to participate or withdraw from the study would not affect their course grades. Course grades were determined solely based on attendance, in-class participation, and the quality of the final picture book project, independent of students' consent to participate in the research..

3. Results

3.1 Baseline characteristics

A total of 80 students enrolled in the course. Among them, 68 met the eligibility criteria, and 61 completed both the pre-course and post-course assessments and were included in the complete-case analysis. Baseline demographic characteristics of the analyzed sample are presented in **Table 2**. The mean age of participants was 22.0 ± 0.816 years. Most participants were female (n = 37, 60.7%). The

largest proportion of participants were in the first year (n = 32, 52.5%), and the most common major was clinical medicine (n = 19, 31.1%).

Table 2: Baseline demographic characteristics of the analyzed sample (n = 61)

Variable	Total(n = 61)
Age	22.0 ± 0.816
Sex	
Male	24(39.3%)
Female	37(60.7%)
Year	
Year 1	32(52.5%)
Year 2	26(42.6%)
Year 3	3(4.9%)
Major	
Clinical Medicine	19(31.1%)
Rehabilitation Medicine	4(6.6%)
Biotechnology	3(4.9%)
Pharmacy	8(13.1%)
Nursing	11(18.0%)
Pediatrics	2(3.3%)
Psychiatry	1(1.6%)
Medical Laboratory Technology	2(3.3%)
Medical Imaging	2(3.3%)
Public Health Administration	4(6.6%)
Bioengineering Technology	2(3.3%)
Dentistry	2(3.3%)
Preventive Medicine	1(1.6%)

3.2 Feasibility and course performance

Of the 68 eligible participants, 61 completed both the pre-course and post-course assessments and were included in the paired analysis. Attendance among the 68 eligible students remained high

throughout the course, ranging from 90% to 100%. The mean overall course score was 85.11 ± 7.99. The mean formative assessment score was 76.90 ± 25.40, and the mean final picture book project score was 88.22 ± 2.88. Informal student feedback further suggested that the course was generally perceived as engaging, interesting, and rewarding.

3.3 Changes in aesthetic learning attitudes

For the primary outcome, the total aesthetic learning attitude score increased significantly after the course (***p* = 0.0047**). At the subscale level, post-course mean item scores were higher than pre-course scores across the cognitive, behavior and affective dimensions. In exploratory analyses with BH-FDR adjustment within the aesthetic learning attitude family, significant improvements remained in the cognitive dimension (MD: 1.820, 95% CI: [0.834, 2.806], ***p* = 0.0005**, q = 0.0014) and the affective dimension (MD: 0.738, 95% CI: [0.134, 1.342], ***p* = 0.0175**, q = 0.0263), whereas the behavioral dimension did not show a significant change after adjustment (MD: 0.07, 95% CI: -0.20 to 0.33, p = 0.6174, q = 0.6174). Details are presented in **Table 3** and **Figure 1**.

Table 3 Pre–post comparison of mean item scores for aesthetic learning attitudes among 61 students($\bar{x}$ ± s)

Period	Cognitive	Behavior	Affective	Total
Pre-course	1.55±0.54	0.83±0.98	1.04±0.82	1.29±0.62
Post-course	1.78±0.32	0.89±0.92	1.29±0.65	1.49±0.45
t	3.692	0.502	2.443	2.935
p	**0.0005**	0.6173	**0.0175**	**0.0047**
MD	1.820	0.197	0.738	2.754
95%CI	[0.834, 2.806]	[-0.587, 0.980]	[0.134, 1.342]	[0.877, 4.631]
Cohen's d	0.473	0.064	0.313	0.376
q	**0.0014**	0.6173	**0.0263**	---

Note:

MD: Mean Difference;

CI: Confidence Interval;

q: Benjamini–Hochberg false discovery rate-adjusted *p* value

q values were calculated only for exploratory subscale analyses within the aesthetic learning attitude family; the total score was prespecified as a primary outcome and was not adjusted for multiple testing.

3.4 Changes in creativity tendency

For the primary outcome, the total creativity tendency score increased significantly after the course (***p* = 0.0079**). At the subscale level, post-course mean item scores were higher than pre-course scores across all four dimensions. In exploratory analyses with BH-FDR adjustment within the creativity tendency family, significant improvements remained in risk-taking (MD: 1.213, 95% CI: [0.262, 2.165], ***p* = 0.0133**, q = 0.0267) and challenge (MD: 1.984, 95% CI: [0.979, 2.998], ***p* = 0.0002**, q = 0.0008), whereas curiosity and imagination were not significant after adjustment.. Detailed data are presented in **Table 4** and **Figure 1**.

Table 4 Pre–post comparison of mean item scores for creativity tendency among 61 students($\bar{x} \pm s$)

Period	Risk-taking	Curiosity	Imagination	Challenge	Total
Pre-course	2.17±0.28	2.27±0.32	2.07±0.34	2.30±0.25	2.21±0.25
Post-course	2.28±0.28	2.37±0.28	2.13±0.34	2.47±0.24	2.31±0.23
t	2.550	1.883	1.254	3.950	2.747
p	**0.0133**	0.06450	0.21466	**0.0002**	**0.00792**
MD	1.213	1.295	0.754	1.984	5.246
95%CI	[0.262, 2.165]	[-0.080, 2.671]	[-0.449, 1.957]	[0.979, 2.998]	[0.979, 2.998]
Cohen's d	0.327	0.241	0.161	0.506	0.352
q	**0.0267**	0.0860	0.2146	**0.0008**	---

Note:

MD: Mean Difference;

CI: Confidence Interval;

q: Benjamini–Hochberg false discovery rate-adjusted *p* value

q values were calculated only for exploratory subscale analyses within the creativity tendency family; the total score was prespecified as a primary outcome and was not adjusted for multiple testing.

4. Discussion

This single-arm pre-post study evaluated a picture book-centered aesthetic education course as an arts-based medical humanities intervention in an elective undergraduate course. The course appeared feasible within this setting, as reflected by course completion and generally favorable course performance, and participation was associated with improvements in self-reported aesthetic learning attitudes and selected dimensions of creativity tendency. In exploratory subscale analyses adjusted for multiple testing using the BH-FDR procedure, significant improvements remained in the cognitive and affective dimensions of aesthetic learning attitude and in the risk-taking and challenge dimensions of creativity tendency. These findings add preliminary quantitative evidence to the growing literature

suggesting that arts- and humanities-based teaching can complement technically oriented medical training by promoting reflection, interpretation, and humanistic engagement[29–31]. However, because this was an uncontrolled pre-post study using self-report measures, the findings should be interpreted as preliminary educational associations rather than evidence of causal effectiveness.

4.1 Course feasibility and overall educational implications

The favorable course scores and completion of the final picture book project suggest that a picture book-centered course can be implemented within a credit-bearing elective format. This is important because one challenge in medical humanities education is not only conceptual justification, but also curricular feasibility. By combining pre-class preparation, multimodal classroom activities, guided discussion, and student-generated outputs, the course provided a structured way to connect visual interpretation, emotional reflection, and creative production. This design is broadly consistent with prior work showing that arts-based teaching can be integrated into medical curricula to support observation, communication, and reflective learning[2, 18, 32]. At the same time, course grades in this study primarily reflect participation and performance within a specific elective context and should not be interpreted as independent evidence of educational effectiveness.

4.2 Changes in aesthetic learning attitudes

Students' learning attitudes and outcomes are central to evaluating educational quality[33, 34]. In the present study, the total aesthetic learning attitude score improved after the course. In addition, after BH-FDR adjustment for multiple subscale comparisons, significant improvements remained in the cognitive and affective dimensions, whereas the behavioral dimension did not, which consistent with findings that arts-based curricula enhance student engagement[2]. From a Herbartian perspective, the course's integration of visual and auditory arts strengthened sensory impressions and facilitated contemplative internalization of aesthetic imagery[35], supporting students’ reflection on humanistic themes[36]. This process aligns with the view that art cultivates sensitivity to detail and promotes caring patterns of thought and behavior[37]. Activities like analyzing picture book visuals and role-playing deepened students' emotional understanding and fostered positive attitudes. The lack of significant change in the behavioral dimension may be attributed to the limited instrument sensitivity to short-term behavioral change, ceiling effects in baseline scores, and insufficient opportunities for transfer beyond the classroom. Future studies should incorporate follow-up assessments and performance-based indicators to evaluate behavioral translation.

4.3 Changes in creativity tendency

The critical need for innovation is widely recognized across global sectors including healthcare[38, 39] and creativity as a malleable competency can be cultivated through systematic intervention[40, 41]. In the present study, the total creativity tendency score improved after the course. After BH-FDR adjustment, significant improvements remained in the risk-taking and challenge dimensions, whereas curiosity and imagination did not remain significant, suggesting differentiated pathways for nurturing

creative traits. Grounded in Amabile's Componential Theory of Creativity[26], the course fostered creativity through a three-level mechanism: building domain-relevant skills via interdisciplinary knowledge; enhancing creative processes through open-ended tasks that break, and activating motivation by anchoring creation in humanistic care. The significant gains in risk-taking and challenge—dimensions closely tied to willingness to explore novel approaches and tackle difficult problems—suggest that the course successfully activated students' creativity-relevant processes and task motivation. These findings align with Amabile's assertion that these components are amenable to targeted educational interventions. The large effect size for challenge is particularly noteworthy, suggesting meaningful gains in students' willingness to tackle difficult tasks—a quality relevant to clinical practice. In contrast, the non-significant changes in curiosity and imagination may reflect these as deeper-seated dispositions requiring more extensive cultivation. Within Amabile's framework, such traits may demand sustained development of domain-relevant skills and repeated exposure to ambiguity-tolerant tasks. This interpretation is consistent with Bugaj et al.'s[42] observation that curiosity in medical learners is shaped by years of educational socialization emphasizing standardized answers and algorithmic reasoning. Thus, transforming these dispositions may require longer-term, spiral curriculum designs that repeatedly expose students to inquiry-driven tasks throughout their training. Future optimizations could extend course duration, introduce curiosity-stimulating exercises earlier in the curriculum, and incorporate clinically-driven exploratory tasks (e.g., narrative imagination exercises based on patient cases) to better stimulate these dimensions.

5. Limitations and further research

This study has limitations. The single-group pre–post design without a control limits causal inference, and results based on self-report may be affected by social desirability and demand characteristics. As an elective course, self-selection and attrition may introduce bias, and no follow-up was conducted to assess durability or transfer. Future work should use controlled designs, include objective/performance-based measures, and add longitudinal follow-up.

6. Declarations

In this single-arm pre–post study, a picture book-centered aesthetic education course guided by a three-dimensional integrated teaching model appeared feasible as an arts-based medical humanities educational strategy in an elective undergraduate setting. Participation was associated with improvements in the two prespecified primary outcomes, namely total aesthetic learning attitude and total creativity tendency scores. In exploratory analyses adjusted for multiple testing, significant improvements remained in the cognitive and affective dimensions of aesthetic learning attitude and in the risk-taking and challenge dimensions of creativity tendency. Because the study used an uncontrolled design and self-report outcomes, these findings should be interpreted as preliminary rather than causal. Further controlled studies with longitudinal follow-up and performance-based outcomes are needed.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and its later amendments. Ethical approval was obtained from the Medical Ethics Committee of Guangzhou Medical University (No. 202411021). Written informed consent was obtained from all participants prior to participation in the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Yanmei Luo, Weisheng Yang, Tongtong Chen, Shiqi Chen, Yujie Zhou, Mei Yang, Xueling Chen and Ye Liu were responsible for data collection, data processing, and manuscript drafting. Zhimin Du and Wei Huang were responsible for study supervision and funding acquisition. All authors read and approved the final manuscript.

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Disclosure statement

There is no conflict of interest among the authors, and they are responsible for the content and writing of the article.

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Figures

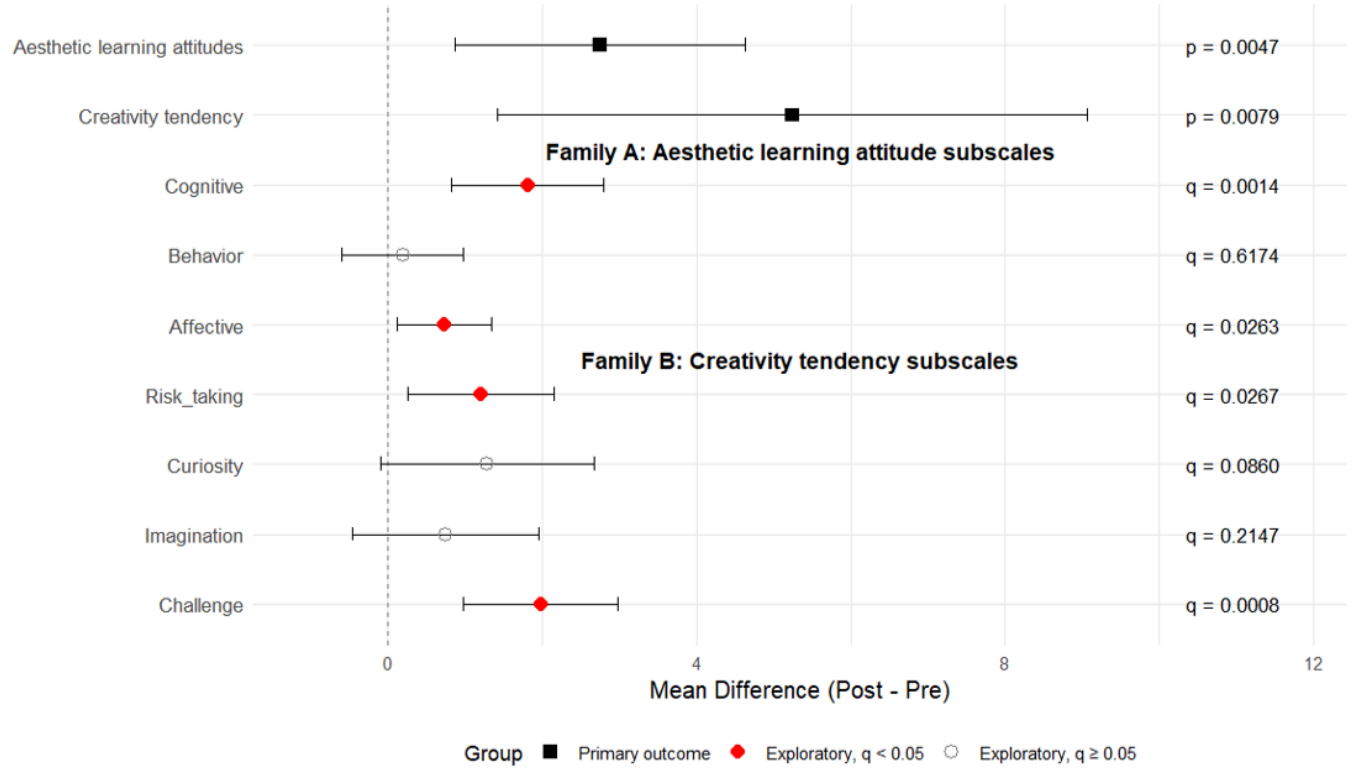

Figure 1

Forest Plot of Paired Differences

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