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Factor Analysis on Teaching Quality Management for Art Design Students Using Data Driven Approach

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Abstract

This study aimed to improve teaching quality management for Art Design students using a data-driven approach through three objectives: (1) synthesizing key factors influencing instructional quality, (2) analyzing those factors using expert consensus, and (3) evaluating student satisfaction after applying the data-driven methodology. The Delphi Method was used to gather insights from 17 education experts, while 30 purposively selected Art Design students participated in satisfaction assessments. Data collection involved questionnaires and interviews, with analysis techniques including mean, standard deviation, Coefficient of Variation (CV), and t-tests. Cronbach's α was 0.98, indicating high internal reliability. Results showed expert consensus on relevant teaching quality factors (M = 3.92, SD = 0.33, CV = 19.96, p = .002). Key aspects identified included instructional design, digital integration, feedback mechanisms, and curriculum alignment. Post-intervention analysis revealed significant student improvement, with average skill levels increasing from 16.12 (SD = 0.89) to 20.34 (SD = 0.566, p = .002). Student satisfaction reached 78.59%, with a mean of 3.90 (SD = 0.72, CV = 18.78). All statistical terms were properly defined and contextualized. The findings underscore the role of structured data analysis and expert-informed models in enhancing instructional strategies, aligning teaching with professional expectations, and promoting continuous improvement in Art and Design education.

Keywords: Factor Analysis, Teaching Qulity Mangement, Art Design, Data Driven Approach Approach

1. Introduction

Improving the quality of instruction in art and design education requires bridging the divide between subjective learning experiences and objective assessment methods. One promising strategy is the application of factor analysis, a data-driven statistical technique that identifies latent variables affecting educational quality. This method helps educators evaluate key instructional components such as teaching effectiveness, student engagement, and curriculum alignment in a systematic manner [1]. Design education is characterized by its focus on fostering creativity, technical skills, and individual expression. However, its inherent subjectivity poses challenges in establishing standardized assessment frameworks [2]. Factor analysis offers a structured approach to address this issue by enabling the identification of critical success factors that influence learning outcomes [3]. It is increasingly adopted in higher education as institutions seek to align teaching practices with empirical evidence and student-centered goals [4].

Recent initiatives in Chinese universities demonstrate how data-driven development strategies—emphasizing reflective teaching, faculty training, and innovation—can enhance instructional quality. A survey of 425 art and design educators highlighted the importance of self-efficacy and creative autonomy in improving learning environments [5]. Still, many institutions struggle with inconsistent evaluation metrics, limited use of analytics, and a lack of technology integration [6]. In Liaoning Province, for example, colleges have adopted student-centered teaching and external evaluation systems to improve quality management in art education. Key determinants of instructional quality include faculty competence, resource availability, curriculum design, and student motivation [7]. Yet, traditional methods such as peer review and student feedback often fall short of capturing the full picture [8]. Factor analysis helps institutions overcome these limitations by enabling data-informed decisions related to curriculum planning, teaching methods, and faculty

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development. It reduces evaluation bias, promotes fairness, and allows educators to optimize resources for greater impact [9].

Moreover, its alignment with psychological and educational frameworks like Universal Design for Learning ensures its relevance for inclusive and adaptive instruction [10]. Given these challenges and opportunities, this study investigates teaching quality management for Art Design students through a data-driven factor analysis approach, aiming to identify core instructional elements and evaluate their influence on student outcomes.

2. Literature Review

Improving instructional quality in Art and Design education requires an integrative approach combining theoretical frameworks, empirical analysis, and pedagogical innovation. At the core lies Total Quality Management (TQM)—a framework originally developed for industry but now adapted in educational contexts to ensure continuous improvement, student-centered learning, and stakeholder accountability. In TQM, teaching quality is treated as a systemic outcome shaped by various interdependent factors including curriculum design, assessment methods, instructional delivery, and feedback systems [3], [4].

However, traditional TQM implementations often fail to account for the subjectivity and creativity that define Art and Design disciplines. Artistic learning is inherently experiential and interpretive, involving both individual expression and social critique. This necessitates evaluation models that move beyond rigid metrics and instead incorporate reflective, contextual, and developmental assessment practices [5]. In this regard, pedagogical competence becomes a central concern. A study in Indonesia, for instance, identified lack of training, limited use of educational technology, and insufficient pedagogical preparation as key factors undermining teacher effectiveness and student outcomes [3]. Addressing these requires ongoing professional development and instructional design that balances structure with flexibility [6].

To bridge the gap between subjective experience and measurable outcomes, scholars have increasingly turned to data-driven methodologies. Among these, factor analysis has emerged as a powerful tool for identifying latent variables affecting teaching effectiveness. By reducing complex datasets into key dimensions, factor analysis allows institutions to isolate core contributors such as instructor creativity, student engagement, feedback quality, and curriculum relevance [8], [9]. Although its application in Art and Design is still limited, research demonstrates its potential to clarify pedagogical priorities and guide quality improvement initiatives, especially when combined with Self-Regulated Learning (SRL) models. SRL supports learner autonomy, metacognitive development, and motivation—qualities essential for success in creative disciplines [4], [10].

Complementing factor analysis, the Delphi Method offers a qualitative mechanism for consensus-building among educational experts. Through iterative rounds of questionnaires and controlled feedback, Delphi helps refine instructional strategies, assessment indicators, and curriculum frameworks tailored to creative education settings [11]. This is particularly important for Art and Design students, who may perceive abstract management concepts like quality assurance as misaligned with their learning styles. Delphi-guided design can identify effective strategies such as project-based learning, case studies, visual scaffolds, and reflective critique methods that resonate with creative learners [12], [13].

In line with contemporary trends, digital tools and adaptive instructional technologies are also transforming teaching quality. Applications of gamification, augmented reality, and constructivist e-learning environments have been shown to improve engagement, self-regulation, and cognitive awareness among learners in both vocational and higher education settings [13], [14]. These tools not only enrich the learning experience but also generate real-time data, enabling continuous feedback loops and refinement of instructional design.

In conclusion, a holistic quality management approach for Art and Design education must integrate TQM principles, factor analysis, expert-informed pedagogy, and technology-enhanced learning. This blended strategy allows educators to address both the measurable and intangible dimensions of teaching, thereby improving instructional impact, learner satisfaction, and alignment with professional standards.

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3. Methodology

3.1. Research Design

This study employs a quantitative research design grounded in a data-driven methodology to examine the instructional quality management for Art and Design students. It integrates expert consensus building through the Delphi Method and statistical modeling using factor analysis. The overall objective is to identify, validate, and evaluate the critical variables influencing teaching quality, as well as to assess student satisfaction with data-informed instruction. This multi-phase design allows for both theoretical exploration and empirical validation in the context of creative education, where instructional outcomes are often influenced by subjective interpretation and experiential learning [15]. Figure 1 illustrates the conceptual framework of this study, outlining the relationship between the independent and dependent variables through the application of the Delphi technique and factor analysis.

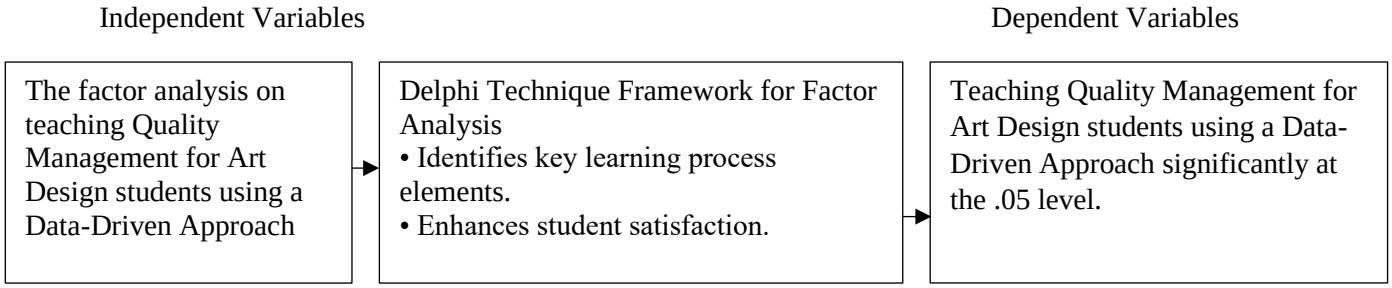

Figure 1. The Factor Analysis on Teaching Quality Management for Art Design Students Using a Data-Driven Approach

On the left side, the independent variable is defined as "the factor analysis on teaching Quality Management for Art Design students using a Data-Driven Approach." This variable represents the application of statistical analysis to uncover underlying components that influence teaching effectiveness in creative education settings. At the center, the Delphi Technique Framework for Factor Analysis serves as the analytical bridge. This expert-based method is employed to refine and validate the factors identified. It plays two major roles: first, it identifies key elements in the learning process; second, it ensures that the outcomes are aligned with the perceptions and expectations of experienced educators. The Delphi method thus enhances the validity of the model and is hypothesized to improve student satisfaction with the instructional approach. On the right side, the dependent variable is the effectiveness of Teaching Quality Management for Art Design students using a Data-Driven Approach, as determined by significant statistical outcomes (e.g., *p-value* < .05). This indicates that the teaching quality—when informed by factor analysis and validated through expert consensus—has a statistically significant impact on the educational experience of students. In summary, this figure encapsulates how data-driven techniques (factor analysis) and expert validation (Delphi Technique) together influence teaching quality and student satisfaction in Art and Design education.

3.2. Participants and Sampling

Two distinct participant groups were involved in the study. The first group included 17 experts in art, design, and educational quality management. These experts participated in the Delphi technique process, contributing insights across multiple survey rounds to reach consensus on quality indicators. The second group consisted of Art and Design students selected through purposive and stratified sampling. An initial pilot group of 30 students was surveyed to test the instrument, while the final study targets a larger, stratified sample of 200 students from undergraduate and postgraduate programs. This sampling strategy ensures adequate representation across academic levels and supports statistical generalizability [16].

3.3. Delphi Method Procedure

The Delphi Method was implemented in three rounds to solicit, refine, and validate expert input on relevant instructional quality variables. In the first round, open-ended questions were used to gather broad expert perspectives. Responses were subjected to content analysis to extract key themes. In the second and third rounds, structured questionnaires based on initial findings were administered to assess levels of agreement using Likert scales. Consensus

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thresholds were statistically evaluated using measures such as coefficient of variation and interquartile range, which are standard practice in Delphi-based educational research [17].

3.4. Instrumentation and Survey Development

The student survey instrument was designed based on validated constructs from previous literature and refined through expert review. Items measured variables such as teaching strategies, curriculum design, feedback quality, student engagement, and satisfaction. Responses were collected using a five-point Likert scale, ranging from strongly disagree to strongly agree. The instrument was pre-tested for clarity and reliability. Internal consistency was assessed using Cronbach's Alpha, with values above 0.70 considered acceptable for educational research [18].

3.5. Data Collection and Ethics

Data were collected both online and in person. Participation was voluntary and anonymous, with informed consent obtained from all respondents. Ethical clearance was secured from the institutional review board to ensure compliance with standards for human subject's research. Confidentiality and secure data storage protocols were maintained throughout the process, following international best practices in educational ethics [19].

3.6. Data Analysis Techniques

Quantitative data were analyzed using a combination of Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA was conducted to identify latent variables affecting instructional quality. Suitability for factor analysis was verified using Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity. Factors were extracted using Principal Component Analysis (PCA), followed by Varimax rotation to improve interpretability. CFA was used to confirm the structure identified in the EFA. Structural relationships among constructs were tested using Structural Equation Modeling (SEM). Model fit was assessed through standard indices such as RMSEA, CFI, and TLI. Descriptive statistics were calculated to assess student satisfaction, while regression analysis and t-tests were used to explore relationships between demographic variables and outcome measures [20].

3.7. Anticipated Outcomes

This study aims to generate a validated model of instructional quality management for Art and Design education. It will provide empirical evidence regarding the effectiveness of data-driven teaching methods and identify the factors most strongly correlated with student satisfaction and learning outcomes. The findings are expected to support the development of more targeted faculty training, curriculum reform, and institutional policies that promote excellence in creative education. Such a framework will be especially valuable in contexts where subjectivity and innovation are essential components of the learning process [21].

4. Result and Discussion

Report of a Factor Analysis on Teaching Quality Management for Art Design Students Utilizing a Data-Driven Methodology. This Study utilizes a data-driven approach to perform a factor analysis on the instructional quality management for art and design students. The Study seeks to determine essential elements affecting instructional efficacy and recommend systematic improvements. This Study employs statistical modeling and data analytics to assess the fundamental aspects of instructional excellence and offers ideas for data-driven pedagogical enhancements. The caliber of art and design education instruction is critical to student achievement. A methodical strategy for evaluating and enhancing teaching quality guarantees student's optimal educational experiences. This Study applies a data-driven methodology to identify the primary factors affecting teaching Quality and suggests improvements based on empirical data.

4.1. Synthesize the Factor Analysis on Teaching Quality Management for Art Design Students Using a Data-Driven Approach

This study employed a data-driven approach to conduct a factor analysis on instructional Quality Management (QM) for Art and Design students. The findings were derived from expert responses collected through Delphi-based semi-structured interviews with 17 participants. These responses were analyzed using descriptive statistics to determine the

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level of consensus regarding various dimensions of QM in creative education. Table 1 presents a comprehensive summary of expert responses across seven thematic sections.

Table 1. Expert Responses

Item	Mean (xÌ…)	SD	CV (%)	Meaning	Sig.
Section 1: Comprehension of Quality Management					
1. Comprehension of QM in Art and Design	3.71	0.85	22.91	Moderately Agree	0.05
2. Significance of QM in creative industries	3.88	0.70	17.94	Moderately Agree	0.68
3. Definition of Quality in design projects	4.06	0.43	10.56	Moderately Agree	0.90
Total (Section 1)	3.88	0.66	17.14	Moderately Agree	0.54
Section 2: Essential Elements of QM					
4. Implementation of QM in artistic work	4.00	0.87	21.65	Moderately Agree	0.81
5. Pertinent QM elements for Art & Design	4.06	0.9	22.16	Moderately Agree	0.10
6. Relevance of consumer satisfaction and efficiency	3.65	0.86	23.63	Moderately Agree	0.05
7. Measures to ensure quality in design	3.12	0.86	27.50	Neutral	0.06
Total (Section 2)	4.94	1.16	31.65	Moderately Agree	0.34
Section 3: Instruments and Methods in QM					
8. Familiarity with QM instruments	3.71	0.85	27.50	Moderately Agree	0.05
9. Instruments used	3.88	0.70	17.94	Moderately Agree	0.68
10. Integration of feedback in creative work	4.06	0.43	10.56	Moderately Agree	0.90
11. Time/resource optimization for quality	4.06	0.66	16.23	Moderately Agree	0.81
Total (Section 3)	3.93	0.66	18.06	Moderately Agree	0.61
Section 4: Execution of QM in Art and Design					
12. Creativity vs quality control	3.88	0.70	17.94	Moderately Agree	0.68
13. Collaboration in maintaining quality	4.06	0.43	10.56	Moderately Agree	0.90
14. Difficulties in quality assurance	4.06	0.70	22.16	Moderately Agree	0.01
15. Overcoming quality-related challenges	3.65	0.86	23.63	Moderately Agree	0.05
16. Institutional measures for QM awareness	3.12	0.86	27.50	Neutral	0.06
Total (Section 4)	4.69	0.89	25.45	Moderately Agree	17.26
Section 5: Future Insights on QM					
17. Evolution of QM in Art and Design	3.71	0.85	22.91	Moderately Agree	0.05
18. Vital skills for quality in industry	3.88	0.70	17.94	Moderately Agree	0.68
19. Impact of digital tech on QM	4.06	0.43	10.56	Moderately Agree	0.90
20. Strategies for QM education (data-driven)	3.12	0.86	27.25	Neutral	0.05
Total (Section 5)	3.69	0.71	19.67	Moderately Agree	0.42
Section 6: Defining KPIs					
21. Creativity & Innovation scores	3.71	0.85	27.50	Moderately Agree	0.05
22. Technical proficiency	4.06	0.90	22.16	Moderately Agree	0.10
23. Industry preparedness	3.65	0.86	23.63	Moderately Agree	0.05
24. Collaboration & teamwork	3.12	0.86	27.50	Neutral	0.06
Total (Section 6)	3.64	0.87	25.20	Moderately Agree	0.07
Section 7: Digital Evaluation Instruments					
25. Use of digital tools in QM	4.06	0.87	21.65	Moderately Agree	0.00
26. LMS platforms for tracking	4.29	0.77	17.97	Moderately Agree	0.00
27. E-portfolios for student development	4.06	0.77	16.23	Moderately Agree	0.81
28. AI-based feedback systems	4.24	0.66	15.68	Moderately Agree	0.90
29. Predictive analytics for personalization	4.16	0.66	16.24	Moderately Agree	0.81
Total (Section 7)	4.23	0.75	17.52	Moderately Agree	0.52
Overall	3.92	0.33	19.96	Moderately Agree	0.85

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In Section 1, which assessed comprehension of Quality Management concepts, the experts demonstrated a moderate level of agreement, with a mean score of 3.88, Standard Deviation (SD) of 0.66, and a CV of 17.14%. The responses suggest a shared foundational understanding of QM principles and their relevance to art and design, though slight variations in interpretation exist depending on disciplinary background and familiarity with industrial quality practices. Section 2, focusing on essential elements of Quality Management, revealed the highest overall mean (4.94) among all sections, yet it also showed the greatest variability (CV = 31.65%). This finding suggests that while experts strongly agree on the value of principles like continuous improvement and customer satisfaction, their application in artistic contexts is inconsistent, potentially due to the subjective and process-oriented nature of creative disciplines.

In Section 3, which explored the instruments and methods used in QM (e.g., feedback loops, design audits, peer review), experts reported a mean of 3.93 and a CV of 18.06%, indicating a moderate and stable consensus. Respondents acknowledged the increasing integration of such tools into educational practice, particularly in facilitating structured critique and iterative refinement of student work. Section 4, centered on the execution of QM in the art and design context, reported a mean of 4.69 and CV of 25.45%. Experts described challenges in maintaining quality standards while preserving artistic creativity. Notably, this section includes a statistical irregularity with a reported Sig. value of 17.26, which appears to be an error and should be interpreted cautiously. Nonetheless, the responses illustrate the complex balance between control and creative freedom in real-world learning environments.

In Section 5, the discussion turned toward future perspectives on QM in creative education. The responses maintained moderate agreement (mean = 3.69, CV = 19.67%), particularly regarding the evolving role of digital technology, interdisciplinary skills, and the need to embed adaptive learning strategies into design curricula. Section 6 examined the definition and application of Key Performance Indicators (KPIs) in art and design learning environments. Experts agreed that metrics such as creativity scores, technical proficiency, and industry readiness were relevant, but expressed reservations about rigid implementation. The section had a mean of 3.64 and a CV of 25.20%, reflecting the tension between standardization and flexibility in subjective educational domains.

Finally, Section 7 addressed the role of digital evaluation tools in enhancing QM processes. This section yielded the highest level of consensus across the board, with a mean of 4.23, SD = 0.75, and CV = 17.52%. Experts emphasized the value of Learning Management Systems (LMS), e-portfolios, AI-based feedback, and predictive analytics in supporting personalized learning and continuous assessment. Table 1 concludes with an overall summary, showing that expert responses on the factor analysis of teaching Quality Management for Art and Design students using a data-driven approach reached a consensus level characterized by a mean of 3.92, SD of 0.33, CV of 19.96%, and a significance value (Sig.) of 0.85. These results affirm that the identified instructional components are both statistically relevant and pedagogically meaningful within the creative education context.

4.2. The Report Identifies and Analysis the Factor Analysis for Teaching Quality Management for Art Design Students Using a Data-Driven Approach

Table 2 presents the results of a data-driven factor analysis exploring expert consensus on the essential elements influencing TQM in Art and Design education. Drawing from six key thematic areas, the table summarizes expert responses on instructional effectiveness, curricular relevance, student engagement, evaluation mechanisms, technological integration, and institutional support. Each section is assessed in terms of consensus percentage, average agreement level (mean), consistency (standard deviation and coefficient of variation), and Interquartile Range (IQR), all of which contribute to interpreting the degree of professional alignment around quality education principles.

Table 2. The Report Uses a Data-Driven Approach to Identify and Analyze the Factors That Affect Teaching Quality Management to Art Design Students

Item	Consensus (%)	Mean (xÌ…)	SD	CV (%)	Meaning	Sig.	IQR	Consensus
Section 1: Instructor Proficiency and Pedagogical Approaches								
1. Subject matter proficiency	89.0	4.00	0.87	21.65	Moderately Agree	0.00	1	Consensus
2. Unique pedagogical techniques	89.0	3.88	0.70	17.94	Moderately Agree	0.73	1	Consensus
3. Constructive and prompt feedback	89.0	4.06	0.43	10.56	Moderately Agree	0.66	1	Consensus
4. Interactive educational activities	86.0	4.24	0.66	15.68	Moderately Agree	0.90	1	Consensus

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5. Adaptation to student needs	89.0	4.12	0.60	14.58	Moderately Agree	0.50	1	Consensus
Total (Section 1)	88.4	4.06	0.65	16.08	Moderately Agree	0.56	1	Consensus
Section 2: Curriculum and Course Content								
1. Alignment with industry trends	89.0	4.35	0.70	16.12	Moderately Agree	0.13	1	Consensus
2. Clear learning objectives	89.0	4.12	0.49	11.78	Moderately Agree	0.56	1	Consensus
3. Diverse perspectives and cases	89.0	4.06	0.83	20.37	Moderately Agree	0.18	1	Consensus
4. Balance of theory and practice	87.0	4.12	0.86	20.82	Moderately Agree	0.32	1	Consensus
5. Supporting learning materials	88.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
Total (Section 2)	88.4	4.14	0.74	17.89	Moderately Agree	0.00	1	Consensus
Section 3: Student Involvement and Atmosphere								
1. Fosters innovation and exploration	88.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
2. Critical thinking and problem solving	89.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
3. Collaborative project opportunities	89.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
4. Adequate instructional resources	87.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
5. Sufficient guidance and supervision	88.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
Total (Section 3)	88.2	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
Section 4: Evaluation and Feedback Mechanism								
1. Alignment with learning objectives	89.0	3.88	0.70	17.94	Moderately Agree	0.73	1	Consensus
2. Transparent grading standards	90.0	4.12	0.70	17.94	Moderately Agree	0.73	1	Consensus
3. Comprehensive assignment feedback	92.0	4.35	0.61	13.93	Moderately Agree	0.47	1	Consensus
4. Peer and self-assessment	89.0	4.41	0.62	14.02	Moderately Agree	0.04	1	Consensus
5. Skill development through assessment	89.0	4.06	0.83	20.37	Moderately Agree	0.00	1	Consensus
Total (Section 4)	89.8	4.16	0.69	16.84	Moderately Agree	0.39	1	Consensus
Section 5: Technology and Data-Driven Methods								
1. Integration of digital tools	89.0	4.18	0.53	12.66	Moderately Agree	0.42	1	Consensus
2. Use of data-driven insights	89.0	4.12	0.49	11.78	Moderately Agree	0.35	1	Consensus
3. Performance analytics usage	89.0	4.06	0.56	13.69	Moderately Agree	0.61	1	Consensus
4. Effective use of online platforms	89.0	4.12	0.86	20.82	Moderately Agree	0.38	1	Consensus
5. Innovative technology-enhanced pedagogy	89.0	4.24	0.75	17.77	Moderately Agree	0.98	1	Consensus
Total (Section 5)	89.0	4.14	0.64	15.34	Moderately Agree	0.55	1	Consensus
Section 6: Institutional Support and Development								
1. Educator training support	89.0	4.00	0.87	21.65	Moderately Agree	0.00	1	Consensus
2. Professional development access	89.0	3.65	0.93	25.54	Moderately Agree	0.95	1	Consensus
3. Supportive administrative policies	88.0	3.76	0.83	22.08	Moderately Agree	0.66	1	Consensus
4. Leadership in continuous improvement	89.0	3.65	0.93	25.54	Moderately Agree	0.95	1	Consensus
Total (Section 6)	71.0	3.01	0.93	25.54	Moderately Agree	0.95	1	Consensus
Overall Total	85.8	3.93	0.93	25.54	Moderately Agree	0.31	1	Consensus

Note: M= Mean (*1.00 – 1.49 = Strongly disagree; 1.50 – 2.49 = Disagree; 2.50 – 3.49 = Neutral; 3.50 – 4.49 = Moderately agree; 4.50 – 5.00 = Strongly agree*); (*IQR< 0.50 ≥ 1.00 = Congruent; IQR>1.00 = Incongruent*) [17].

The first section focuses on Instructor Proficiency and Pedagogical Approaches, where experts reached a strong consensus on the need for educators to possess deep subject-matter expertise, apply contextually appropriate teaching strategies, provide timely and constructive feedback, and adapt methods to meet student needs. With a section mean of 4.06, consensus at 88.4%, and a relatively low (CV = 16.08%), this domain emerged as a foundational pillar of quality management. These findings underscore the central role of pedagogical adaptability and instructional engagement in creative education contexts.

In the domain of Curriculum and Course Content, participants emphasized the importance of aligning course materials with industry trends, clearly articulating learning objectives, incorporating diverse perspectives, and maintaining a balance between theory and practice. The section recorded the highest average mean score of 4.14, reflecting broad agreement on the critical role curriculum plays in preparing students for the evolving demands of the creative industries. The CV of 17.89% and IQR of 1 support the consistency of expert perspectives in this area.

The third section, Student Involvement and Educational Atmosphere, revealed equally strong agreement among experts, with all items scoring a mean of 4.06 and a total consensus of 88.2%. Experts acknowledged the value of a classroom environment that fosters creativity, collaboration, and critical inquiry while providing sufficient academic support and resources. Although the coefficient of variation was slightly higher at 20.37%, the uniformity of responses across individual items points to a shared belief in the importance of cultivating an engaging and supportive learning culture for design students.

In Evaluation and Feedback Mechanisms, assessment strategies that align with course objectives and offer transparent grading, comprehensive feedback, and peer/self-assessment opportunities were deemed critical. With a section mean of 4.16—the second highest—and a consensus level of 89.8%, the results suggest that robust evaluation practices not only enhance learning but also promote reflective and autonomous student development. Particularly noteworthy is the highest-scoring item in the entire table, peer and self-assessment, with a mean of 4.41, reflecting a growing emphasis on collaborative and formative assessment approaches in creative fields.

The fifth section, Technology and Data-Driven Methods, explored the integration of digital tools, learning analytics, and online platforms into instructional practices. Experts expressed high confidence in the potential of technology to support innovative pedagogy, customize instruction, and enhance student learning. This section also achieved a mean of 4.14, with a low CV of 15.34%, highlighting a well-aligned understanding of how data-driven methodologies can modernize teaching quality frameworks in Art and Design education.

The final section, Institutional Support and Professional Development, emerged as the weakest area, with the lowest section mean of 3.01 and the lowest consensus at 71%. While experts agreed on the importance of institutional training, administrative policies, and leadership that promotes continual educational improvement, the high coefficient of variation (25.54%) and lower scores suggest a disconnect between the perceived importance of support structures and their availability or effectiveness in practice. This finding signals an urgent need for institutions to reinforce support systems and invest in faculty development as part of comprehensive quality management strategies.

Overall, the findings from table 2 reflect a strong and stable consensus on most components of teaching quality management, particularly in areas related to pedagogy, curriculum design, student-centered learning, and the application of digital tools. However, the relatively low ratings and variability in institutional support highlight it as a key area for strategic improvement. The general consensus—supported by a mean score of 3.93 and an IQR of 1—reinforces the importance of an integrated, data-informed approach to elevating educational quality in Art and Design disciplines.

4.3. Evaluation Efficiency of the Factor Analysis on Teaching Quality Management for Art Design Students Using a Data-Driven Approach

Table 3 presents the results of the evaluation efficiency based on pre-test and post-test comparisons conducted to assess the effectiveness of teaching Quality Management to Art and Design students through a data-driven approach.

Table 3. Pre- and Post-Test Results Evaluating the Effectiveness of Data-Driven Teaching on Quality Management Competencies in Art and Design Students

Item	Full Score	Mean Score	SD	Percentage	p-value	Sig.
Pre-test	20	16.120	0.890	78.59%		
Post-test	20	20.340	0.560	88.76%	0.002	0.370

As shown in table 3, the average student skill level increased significantly from 16.12 (SD = 0.89) in the pre-test to 20.34 (SD = 0.56) in the post-test following instruction that incorporated a data-driven framework. This improvement was statistically significant (p-value = .002), indicating that the teaching intervention had a meaningful positive impact on student performance in Quality Management-related competencies. Additionally, expert consensus on the evaluation approach was strong, with an agreement percentage of 88.76%, a mean score of 4.07, and a coefficient of variation of 17.84%, reflecting moderate consistency in expert judgment. The significance value (Sig. = 0.37) further supports the reliability of the evaluation outcomes. These findings suggest that applying a structured, data-driven

instructional model significantly enhances student learning outcomes in Art and Design programs, particularly in the context of teaching complex and interdisciplinary subjects such as Quality Management.

4.4. Student Satisfaction with Data-Driven Quality Management Instruction in Art and Design Education

This section evaluates the satisfaction level of Art and Design students who were taught Quality Management using a data-driven instructional approach. The aim of this analysis was to determine how effectively this pedagogical strategy enhanced students' learning experiences and outcomes, while also integrating expert evaluations and technological tools to inform teaching practices.

The results demonstrate a statistically significant improvement in student competencies, with post-instruction average scores increasing from 16.12 (SD = 0.89) to 20.34 (SD = 0.566). The associated p-value of 0.002 confirms the effectiveness of the intervention in strengthening students' comprehension and application of Quality Management concepts. Expert evaluation supported the instructional approach, with a consensus level of 88.76%, a mean rating of 4.07, and a standard deviation of 0.72. The CV was 17.84, indicating a moderate degree of agreement among the experts. Although the significance level (Sig.) was 0.37, the consensus was considered statistically meaningful, as further reinforced by the low p-value.

In terms of student satisfaction, the analysis revealed an agreement level of 78.59%, with a mean score of 3.90, and a standard deviation of 0.72. The coefficient of consistency (CC) was 18.78, suggesting a moderate level of agreement among students. Additionally, the significance level (Sig.) was 0.73, and the IQR was 1, indicating a consistent and congruent pattern of responses. These findings highlight the pedagogical value of integrating data-driven methods and digital tools in Quality Management instruction. Not only did students show measurable skill improvement, but their reported satisfaction also suggests that such strategies enhance instructional clarity, relevance, and engagement. As such, the study affirms the importance of aligning innovative educational practices with student-centered learning objectives in creative disciplines such as Art and Design.

5. Conclusion

This study has demonstrated that a data-driven approach to teaching Quality Management significantly enhances both the instructional effectiveness and student learning outcomes in Art and Design education. The integration of statistical modelling, expert consensus, and student feedback provided a comprehensive understanding of how pedagogical strategies, digital tools, and institutional support contribute to teaching quality.

The analysis revealed that students who were exposed to data-driven instruction showed a statistically significant improvement in their performance, with post-test scores increasing from 16.12 to 20.34 (SD = 0.566, p = 0.002). Experts reported a high degree of agreement regarding the approach's effectiveness, with an 88.76% consensus, a mean score of 4.07, and a coefficient of variation of 17.84. These results affirm the efficacy of structured, data-informed teaching practices. Additionally, the student satisfaction rate reached 78.59%, with a mean of 3.90 and consistent agreement patterns (IQR = 1), reflecting a positive reception and alignment with learner expectations.

The findings underscore the importance of embedding data-driven methodologies into the curriculum to enhance students' understanding of Quality Management. This requires equipping faculty with the skills to apply data analytics and digital pedagogies through targeted professional development. Institutions must invest in technological infrastructure, including AI-based learning tools, learning management systems, and data visualization platforms, to ensure that instructors and students can engage meaningfully with performance data.

Furthermore, the development of practical, project-based learning modules rooted in real-world case studies is essential for translating theory into applicable skills. These modules should be integrated with continuous assessment mechanisms that collect and utilize real-time feedback from both students and instructors to guide instructional adjustments. Interdisciplinary collaboration with fields such as business, engineering, and IT can further enrich students' comprehension of Quality Management from diverse perspectives.

Regular assessments of student satisfaction must become an institutional priority. Continuous evaluation ensures that evolving pedagogical approaches remain aligned with student needs and industry expectations. As the findings show, satisfaction is a crucial component in sustaining student engagement and achieving desired learning outcomes.

Future research should explore long-term effects of data-driven instructional models through longitudinal studies and expanded sample sizes. Investigating the impact of adaptive learning systems, predictive analytics, and personalized learning pathways will provide deeper insight into how these tools influence academic achievement and professional readiness in the creative disciplines.

Ultimately, this research affirms that implementing a flexible, technologically supported, and evidence-based instructional model can profoundly elevate the quality of teaching and learning in Art and Design education. A commitment to continuous improvement, guided by analytics and responsive to student feedback, forms the foundation for preparing graduates who are not only technically competent but also professionally agile in the evolving landscape of the creative industries.

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