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Architectural Design Activism Education: Empirical Validation and Prioritization of Conceptual Factors Using Expert Consensus and Quantitative Methods

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ABSTRACT

Objective: This study aims to develop and empirically validate an enhanced conceptual model for activism-oriented architectural design education, improving upon the authors' previous model by incorporating data-driven prioritization of influential factors.

Methods: A mixed-methods approach was adopted. First, qualitative findings from an earlier study were used to identify forty indicators categorized into four conceptual clusters: individual, educational infrastructure, societal phenomena, and educational system components. Expert consensus was examined through three Delphi rounds and Kendall's W statistics. Instrument validity and reliability were confirmed. Non-Negative Least Squares (NNLS) regression followed by the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) analysis were applied to assess and rank the factors based on their positive influence.

Results: Findings indicated strong expert agreement on factor importance (Kendall's W = 0.705 in the final round). Experiential learning, critical inquiry, performance assessment, creative studio environment, and social responsibility were identified as the most influential factors in strengthening activism competencies in architectural design education.

Conclusion: The updated conceptual model serves as a data-driven decision-support tool for enhancing architectural curricula toward socially responsible outcomes. It also establishes a foundation for developing supervised AI-based assessment models to evaluate students' activism learning potential in future research.

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Introduction

Architectural education is increasingly expected to equip future architects with the ability not only to respond to but to critically engage with social and environmental challenges. In this context, design activism has emerged as a transformative pedagogical paradigm, encouraging students to adopt an active and responsible role toward the built environment and society. This shift reflects a broader recognition that architectural practice must go beyond technical solutions, fostering designers who can challenge conventional norms and advocate for equitable and sustainable change (Davis and Dubberly, 2023; Fuad-Luke, 2013).

Despite the growing significance of design activism, its systematic integration into architectural design education remains underdeveloped (Brosens, Raes, Octavia, and Emmanouil, 2023). Existing educational frameworks often struggle to provide learners with structured opportunities to critically reflect, collaborate, and shape design outcomes aligned with community needs. Consequently, there is a growing demand for conceptual and empirical models that can guide the effective incorporation of activism competencies within architectural studio pedagogy (Aksamija, 2021; Felix, 2024). In a previous study by the authors, foundational qualitative research identified forty key factors influencing activism-oriented learning in architectural design studios. However, the initial conceptual model lacked empirical prioritization to determine the relative influence of these factors (Babapour, Alimohammadi, and Matin, 2025). To address this gap, the present study advances the prior model by incorporating expert consensus, quantitative weighting, and multi-criteria decision-making to validate and classify the importance of each factor. Thus, this study addresses a critical need in architectural education through a data-driven evaluation of influential components within the activism learning process. The findings aim to inform curriculum developers, design educators, and policymakers seeking to strengthen students' activism competencies in architectural design studios and support socially responsible professional formation. The outcomes are intended to support more socially just and community-responsive design education (Mehan and Dominguez, 2024).

Materials and Methods

This study adopts a mixed-methods approach integrating qualitative foundations with expert consensus analysis and quantitative evaluation to prioritize the most influential factors in activism-oriented architectural design education (Creswell and Plano Clark, 2023). The methodological process comprises four sequential phases: identification and thematic clustering of influencing factors based on prior qualitative expert consensus assessment using the Delphi technique and Kendall's W statistic; confirmation of instrument validity and reliability; and (4) quantitative prioritization using Non-Negative Least Squares (NNLS) regression and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method.

Identification and Clustering of Factors

Before conducting the Delphi process, a set of factors influencing activism-oriented architectural design education was identified in a previous qualitative study by the present authors. In that research, inductive qualitative content analysis using ATLAS.ti software was applied to analyze in-depth interviews, studio observations, and curriculum documents. Through multiple stages of open, axial, and selective coding, forty key factors were extracted.

These factors were thematically categorized into four conceptual clusters:

1.Individual components
2.Educational infrastructure components
3.Societal phenomenon components
4.Educational system components

This clustering provided the structural basis for the Delphi questionnaire administered in the current study. Details of the qualitative analysis are reported in: Babapour, M., Alimohammadi, P., & Matin, M. (in press). *Exploring the Influential Factors in the Foundational Education Process of Architectural Design Activism. Journal of Architecture and Sustainable Environment.*

Table 1. Forty identified factors and related questionnaire items (Q1–Q40) derived from prior qualitative analysis.

Code	Factor	Cluster
Q1	Personal interests of the designer	Individual Factors
Q2	Questioning skills	Individual Factors
Q3	Visual awareness	Individual Factors
Q4	Social skills	Individual Factors
Q5	Personal motivation	Individual Factors
Q6	Sense of design ownership	Individual Factors
Q7	Future-oriented thinking	Individual Factors
Q8	Emotional intelligence	Individual Factors
Q9	Mental perception	Individual Factors
Q10	Active teaching	Educational Infrastructure Factors
Q11	Strategies of activist designers	Educational Infrastructure Factors
Q12	Technology utilization	Educational Infrastructure Factors
Q13	Problem-solving ability	Educational Infrastructure Factors
Q14	Experiential learning	Educational Infrastructure Factors
Q15	Social and ethical values	Socio-cultural Factors

Q16	Performance assessment	Educational Infrastructure Factors
Q17	Learning approaches	Educational Infrastructure Factors
Q18	Interdisciplinary studies	Educational Infrastructure Factors
Q19	Social responsibility	Socio-cultural Factors
Q20	Critical thinking	Individual Factors
Q21	Synergistic collaboration	Educational Infrastructure Factors
Q22	Action research	Educational Infrastructure Factors
Q23	Sustainability and green architecture	Socio-cultural Factors
Q24	Facilitation techniques	Educational Infrastructure Factors
Q25	Professional interventions	Educational Infrastructure Factors
Q26	Flexibility	Individual Factors
Q27	Interaction and participation	Educational Infrastructure Factors
Q28	Human networking	Socio-cultural Factors
Q29	Environmental responsibility	Socio-cultural Factors
Q30	Social impact analysis	Socio-cultural Factors
Q31	Creative studio environment	Educational Infrastructure Factors
Q32	Research limitations	Educational System Factors
Q33	Studio space role	Educational Infrastructure Factors
Q34	Lack of educational infrastructure	Educational System Factors
Q35	Political governing patterns	Educational System Factors
Q36	Historical impacts	Socio-cultural Factors
Q37	Impacts of cultural phenomena	Socio-cultural Factors
Q38	Impacts of social phenomena	Socio-cultural Factors
Q39	International and intercultural relations	Socio-cultural Factors
Q40	Economic impacts	Educational System Factors

Source: Babapour et al., in press.

Delphi Method and Expert Consensus Analysis

To reach expert consensus regarding the relevance and importance of the identified factors, a three-round Delphi survey was conducted among ten experts (Turoff and Linstone, 1975). All participants held a PhD degree in architecture, had at least ten years of teaching experience in architectural design studios, and were familiar with the concept of design activism. The questionnaire included forty items (Q1–Q40), representing the influencing factors extracted in the

qualitative phase. Experts rated each item using a nine-point Likert scale (1 = least important, 9 = most important. After each round, responses were analyzed and feedback was provided to experts, enabling refinement and improvement toward convergence of opinions. Items with high disagreement were revised based on expert feedback before proceeding to the next round.to statistically assess consensus among experts, Kendall's W (coefficient of concordance) was calculated in each round (Cucuzzella, Hazbei, and Asgari, 2024; Kendall, 1948).

Round 1

In the first Delphi round, experts evaluated the importance of all forty items using a nine-point Likert scale. The results showed a low level of agreement among experts (Kendall's W = 0.180). Several items demonstrated high variability in responses and therefore required revision and clarification before proceeding to the next round.

Round 2

Following questionnaire refinement and additional clarification provided through interviews with five experts, the second-round survey was administered. The agreement among experts improved to a moderate level (Kendall's W = 0.442). However, consensus was still not sufficient for final confirmation of all items.

Round 3

In the third round, experts re-evaluated the revised items. The results indicated a strong level of agreement among participants (Kendall's W = 0.705), demonstrating that an acceptable level of consensus had been achieved. All forty items were therefore confirmed and retained for subsequent quantitative analyses.

Instrument Validity and Reliability

The same questionnaire used in the authors' previous research was employed to evaluate the influencing factors of activism-oriented architectural design education. Content validity of the instrument had already been established through expert review, confirming the appropriateness of all items in measuring the intended constructs. Moreover, the internal consistency reliability of the instrument was verified using Cronbach's alpha, which demonstrated an excellent value of $\alpha = 0.94$ (Babapour et al., 2025) since no modifications were applied to the questionnaire structure or measurement items in the present study, the reliability analysis was not repeated (Kline, 1999; Mirjalili and Rahmani, 2024).

Normality and Assessment

Before conducting the quantitative analyses, the distribution of expert rating data was examined. To assess the normality assumption, both the Shapiro–Wilk test and the Kolmogorov–

Smirnov test (with Lilliefors significance correction) were applied to the composite scores of the identified factors (Razali and Wah, 2011). A significance level of 0.05 was adopted for interpretation.as shown in Table 2, all significance values (Sig.) were greater than 0.05 in both tests, indicating that the data did not significantly deviate from a normal distribution. Therefore, the use of parametric statistical techniques in the subsequent NNLS regression and TOPSIS analyses was supported.

Table 2. Normality test results (Shapiro–Wilk and Kolmogorov–Smirnov) for expert rating data.

Cluster	Shapiro–Wilk Sig.	Kolmogorov–Smirnov Sig.	Normality Decision
Individual components	> 0.05	> 0.05	Normal distribution
Educational infrastructure components	> 0.05	> 0.05	Normal distribution
Societal phenomena components	> 0.05	> 0.05	Normal distribution
Educational system components	> 0.05	> 0.05	Normal distribution

Descriptive Analysis of Expert Ratings

A preliminary descriptive analysis was conducted to examine the central tendency and dispersion of expert ratings across the forty factors. Mean values for all items were higher than 4 on the 9-point Likert-type rating scale, indicating that all factors were perceived as relatively important by the expert panel. Standard deviation values were within an acceptable range, reflecting a reasonable level of agreement in scoring.as summarized in Table 3, representative items from each conceptual cluster demonstrated consistent patterns of high perceived importance, supporting the overall reliability and internal coherence of expert evaluations.

Table 3. Descriptive statistics of expert ratings across conceptual clusters (mean and standard deviation values).

Code	Factor	Mean	Std. Deviation	Cluster
Q3	Visual awareness	4.60	1.94	Individual Factors
Q14	Experiential learning	4.60	2.17	Educational Infrastructure
Q19	Social responsibility	4.16	2.07	Socio-cultural Factors
Q30	Social impact analysis	5.28	1.72	Socio-cultural Factors
Q32	Research limitations	5.56	1.45	Educational System
Q33	Studio space role	5.36	1.68	Educational Infrastructure

Pearson Correlation Analysis

Pearson correlation coefficients were calculated to examine the relationships among the forty factors. The analysis revealed multiple significant positive correlations ($r > 0.30$), indicating potential synergistic interactions between specific factors. These correlations suggest that certain

components reinforce one another when integrated into educational strategies for activism-oriented architectural design learning.as shown in Table 4, the strongest positive relationships were observed among factors related to experiential learning, social responsibility, and collaborative studio culture, which are particularly relevant for refining and validating the conceptual model.

Table 4. Pearson correlation coefficients among key influencing factors (r > 0.30).

Factor Pair	Pearson r	Interpretation
Q12 (Technology utilization) — Q6 (Design ownership)	0.451	Strong positive synergy
Q1 (Personal interests) — Q7 (Future-oriented thinking)	0.439	Motivation improves future vision
Q4 (Social skills) — Q20 (Critical thinking)	0.422	Critical collaboration strengthens activism
Q3 (Visual awareness) — Q4 (Social skills)	0.284	Interaction enhances spatial perception
Q30 (Social impact analysis) — Q19 (Social responsibility)	0.330	Increased community awareness

NNLS Regression Analysis

To determine the positive contribution of each factor to the dependent variable—defined as the effectiveness of activism-oriented architectural design education—a Non-Negative Least Squares (NNLS) regression model was applied (Behzadian, Otaghsara, Yazdani, and Ignatius, 2012; Lawson and Hanson, 1995). The NNLS technique constrains all regression coefficients to zero or positive values, ensuring theoretical consistency by preventing the assignment of negative effects to educational factors. The analysis identified ten factors with meaningful positive coefficients, indicating their strong influence on the effectiveness of activism-oriented design education. These results emphasize the critical role of experiential learning, critical inquiry, creative studio culture, and social responsibility in strengthening activism-related competencies.as summarized in Table 5, the NNLS regression coefficients illustrate the relative magnitude of each factor's contribution to the dependent variable.

Table 5. Results of the Non-Negative Least Squares (NNLS) regression analysis for key influencing factors.

Rank	Code	Factor	Weight (Creswell & Plano Clark)
1	Q2	Questioning skills	0.706
2	Q5	Personal motivation	0.378
3	Q8	Emotional intelligence	0.373
4	Q19	Social responsibility	0.361
5	Q6	Design ownership	0.302
6	Q20	Critical thinking	0.282
7	Q15	Ethical and social values	0.267
8	Q29	Environmental responsibility	0.238
9	Q30	Social impact analysis	0.161
10	Q10	Active teaching	0.144

Final Conceptual Model Development

Based on the NNLS regression and Pearson correlation analyses, ten key factors influencing the effectiveness of activism-oriented architectural design education were selected as the core variables of the conceptual model. To improve structural validity, all factors showing negative interactive correlations with these main variables were excluded from the framework to prevent cross-factor interference. Conversely, variables with positive synergistic effects were retained as secondary supportive factors positioned in the outer layers of the model. Consequently, the revised conceptual model emphasizes mutual reinforcement among key dimensions and the elimination of conflicting variables.

The final conceptual structure consists of four main clusters:

1. **Individual Factors** (e.g., questioning skills, personal motivation, emotional intelligence)
2. **Socio-ethical Factors** (e.g., social and environmental responsibility)
3. **Educational Factors** (e.g., critical thinking, active teaching)
4. **Systemic and Infrastructure Factors** (e.g., problem-based design and institutional values)

This refined model demonstrates that improving the effectiveness of activism-oriented architectural design education depends on a dynamic interaction between individual motivation, social awareness, and participatory learning strategies.

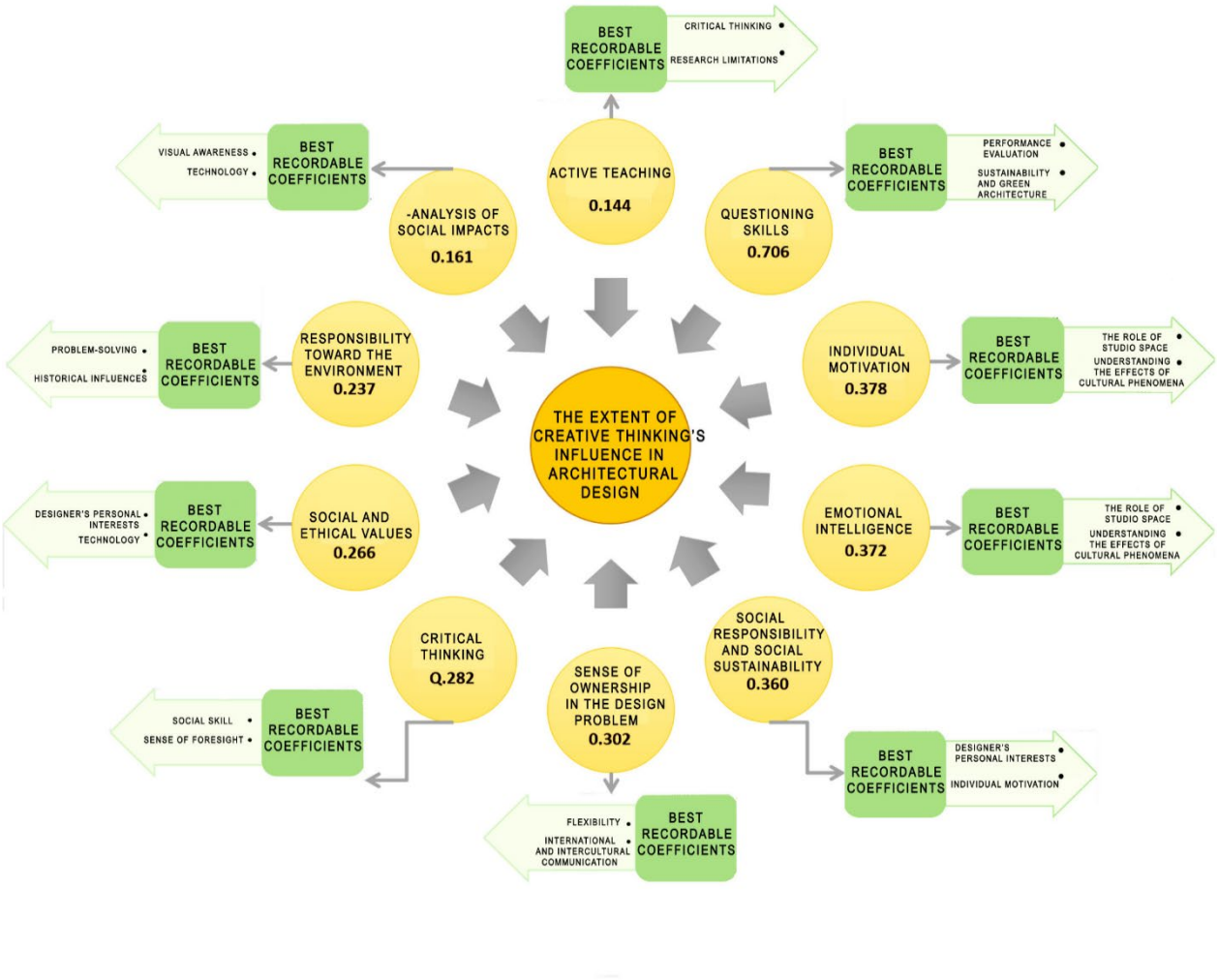


Figure 1. Refined conceptual model of activism-oriented architectural design education.

Development of Educational Alternatives

Following the identification of ten key influential factors on the effectiveness of activism-oriented architectural design education through NNLS regression, four implementable educational alternatives were formulated. These alternatives were developed based on a comprehensive review of architectural design studio syllabi (Design 1–5) and expert consultations with five faculty members experienced in design studio instruction. The aim of these alternatives is to directly translate the conceptual findings into pedagogically actionable strategies within the existing curriculum.

A1. Elective Course: Activism in Architectural Design Education

- 2–credit hybrid course (theoretical + workshop-based)
- Recommended for mid-level design studios (Design II or III)

Proposed content:

- Case-study analysis of spatial justice issues
- Real stakeholder engagement
- Action-research approaches
- Collaborative solution-making

Key factors addressed: Q2, Q5, Q8, Q19, Q30, Q15

A2. Dedicated Chapter on Activism in Design IV and V

- Embedded within existing core design courses
- Direct alignment with complex urban-scale projects

Proposed activities:

- Social and environmental impact assessment
- User participation documentation
- Presentation of evidence-based design decisions

Key factors addressed: Q19, Q29, Q6, Q15

A3. Progressive Refinement of Design Studio Sequence (Design I–V)

- Structured, incremental integration of activism
- Promoting continuity and cumulative learning outcomes

Table 6. Proposed educational alternatives for implementing the conceptual model in architectural design education

Studio Course	Focus Area	Key Skills Developed
Design I	Fundamental questioning	Q2, Q5
Design II	Experiential learning in the studio	Q10, Q8
Design III	Social engagement	Q19, Q20
Design IV	Environmental + cultural impact	Q29, Q30
Design V	Advanced activism integration	All 10 key factors

A4. Extra-Curricular Activism Workshops

- Short-term community-based interventions
- Collaboration with NGOs, municipalities, and cultural organizations

Expected outcomes:

- Strengthened communication skills
- Enhanced environmental and social awareness
- Application of design activism in real contexts

Evaluation Criteria for Alternatives (TOPSIS Analysis Inputs)

To ensure data-driven prioritization of the proposed educational alternatives (A1–A4), a set of six evaluation criteria was established. These criteria were validated through expert consensus

and directly derived from the updated conceptual model, ensuring theoretical coherence between the conceptual and applied phases of the research. The selected criteria represent a balanced combination of pedagogical, institutional, and social dimensions, enabling a comprehensive evaluation of each alternative's impact and feasibility.as summarized in Table 7, each educational alternative was assessed against the six criteria using a five-point rating scale (1 = very low, 5 = very high). The resulting decision matrix served as the primary input for the subsequent TOPSIS analysis to determine the most effective implementation strategy.

Table 7. Evaluation criteria and rating matrix for the proposed educational alternatives (TOPSIS input data).

Code	Criterion	Type	Justification
C1	Educational effectiveness	+	Direct alignment with core research objective
C2	Feasibility within current educational system	+	Realistic potential for implementation
C3	Sustainability of learning outcomes	+	Long-term pedagogical influence
C4	Required cost and resources	–	Consideration of institutional limitations
C5	Stakeholder engagement	+	Consistency with activism principles
C6	Coverage of activism-related competencies	+	Based on the ten key weighted factors

These six criteria serve as the input parameters for the TOPSIS decision matrix.

Evaluation and Prioritization of Alternatives Using TOPSIS Method

To rank and select the most effective educational strategies for enhancing architectural design activism education, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method was applied. This method assumes that the optimal alternative has the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution.

Based on the developed conceptual model and the weighted factors obtained from the NNLS regression, four educational alternatives (A1–A4) were evaluated according to six key criteria (C1–C6). Among these criteria, four were defined as beneficial (positive) and two as non-beneficial (negative). The two non-beneficial criteria include C4 (Cost and Required Resources) and C5 (Educational Load), both of which decrease the overall desirability of an alternative, while the remaining four criteria contribute positively to performance and impact.

Construction of the Decision Matrix

At this stage, data collected from expert questionnaires were organized into a decision matrix. Each alternative (A1–A4) was assessed against each criterion (C1–C6) on a normalized scale ranging from 0 to 1. Positive criteria were considered to increase desirability, whereas the two negative criteria (C4 and C5) represented cost and additional workload that reduce

performance.as shown in Table 8, the constructed decision matrix summarizes the normalized performance values of each alternative across the six evaluation criteria.

Table 8. Normalized decision matrix for the four educational alternatives (A1–A4) evaluated using the TOPSIS method.

Criterion Code	Criterion Name	Effect	Description
C1	Educational Effectiveness	+	Enhances the quality of activist-oriented architectural design learning
C2	Implement ability within Educational System	+	Feasibility of application in the current design education structure
C3	Learning Sustainability	+	Continuity and long-term influence of educational effects
C4	Cost and Required Resources	–	Level of expenses and resources needed for implementation
C5	Educational Load	–	Additional workload imposed on courses or teaching structure
C6	Coverage of Activism Components	+	Extent to which the approach addresses conceptual model factors

Calculation of the Weighted Normalized Matrix

After constructing the normalized decision matrix, each criterion is multiplied by its respective weight to form the weighted normalized matrix (Davis and Dubberly, 2023).

The calculation follows the formula:

$W_j \times R_{ij} = V_{ij}$

V_{ij} = Weighted normalized value for alternative i and criterion j

W_j = Weight of criterion j

R_{ij} = Normalized value of alternative i under criterion j

This step ensures that the relative importance of each criterion is incorporated into the evaluation process.

```
Weighted Normalized Decision Matrix:
[[0.0615 0.0277 0.0215 0.0183 0.0685 0.0396]
 [0.1467 0.0739 0.0883 0.0548 0.1294 0.0099]
 [0.1845 0.0947 0.0955 0.0647 0.156  0.0088]
 [0.1751 0.0855 0.0716 0.0498 0.1294 0.0275]]
```

Determination of Positive and Negative Ideal Solutions

The next step in the TOPSIS method is to identify the Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS).

The PIS represents the most desirable level for each criterion, while the NIS corresponds to

For benefit (positive) criteria: $A^+ = \{V_1^+, V_2^+, \dots, V_n^+\} = \{\max(V_ij) \mid j \in J_benefit\}$

For cost (negative) criteria: $A^- = \{V_1^-, V_2^-, \dots, V_n^-\} = \{\min(V_ij) \mid j \in J_cost\}$

A^+ = Positive ideal solution

A^- = Negative ideal solution

J_benefit = Set of benefit (positive impact) criteria

J_cost = Set of cost (negative impact) criteria

In this study, two criteria (C_4 and C_6) are cost criteria with negative effects, while the other four are benefit criteria.

```
Weighted Normalized Decision Matrix:
[[0.0615 0.0277 0.0215 0.0183 0.0685 0.0396]
 [0.1467 0.0739 0.0883 0.0548 0.1294 0.0099]
 [0.1845 0.0947 0.0955 0.0647 0.156  0.0088]
 [0.1751 0.0855 0.0716 0.0498 0.1294 0.0275]]

A+ (Positive Ideal Solution):
[0.1845 0.0947 0.0955 0.0647 0.0685 0.0088]

A- (Negative Ideal Solution):
[0.0615 0.0277 0.0215 0.0183 0.156  0.0396]
```

Calculation of the Separation Measures

The separation of each alternative from the positive and negative ideal solutions is computed using the Euclidean distance approach.

Distance from the Positive Ideal Solution:

$$S_i^+ = \sqrt{\Sigma} (V_ij - V_j^+)^2$$

Distance from the Negative Ideal Solution:

$$S_i^- = \sqrt{\Sigma} (V_ij - V_j^-)^2$$

S_i^+ = Distance of alternative i from the positive ideal

S_i^- = Distance of alternative i from the negative ideal

These values express how far or close each alternative is to the optimal and least desirable conditions.

```
Distance to A+ (D+):
[0.1679 0.0756 0.0875 0.0709]

Distance to A- (D-):
[0.0875 0.1295 0.1679 0.1435]
```

Calculation of the Relative Closeness to the Ideal Solution

Finally, the relative closeness coefficient (C_i) for each alternative is calculated as follows:

$$C_i = S_i^- / (S_i^+ + S_i^-)$$

C_i ranges between 0 and 1.

A value closer to 1 indicates a more desirable alternative (closer to the ideal solution).

A value closer to 0 indicates a less favorable alternative.

Ranking of Alternatives

After computing C_i for all four alternatives, they are ranked in descending order. The alternative with the highest C_i value represents the most preferred educational strategy for promoting architectural design activism learning.

This ranking provides a quantitative basis for strategic decision-making in curriculum planning and design pedagogy improvement.

Final Results Table:

	Alternative	D+ (Distance to Ideal)	D- (Distance to Anti-Ideal)	\
0	A1	0.1679	0.0875	
1	A2	0.0756	0.1295	
2	A3	0.0875	0.1679	
3	A4	0.0709	0.1435	

	CL (Relative Closeness)
0	0.3426
1	0.6313
2	0.6574
3	0.6694

Results

The findings of this study revealed that improving activism-oriented architectural design education requires simultaneous attention to individual, socio-ethical, and pedagogical dimensions (Fuad-Luke, 2013; Manzini, 2015). The NNLS regression analysis demonstrated that questioning skills, personal motivation, emotional intelligence, and social responsibility had the strongest effects on effectiveness (Salovey and Mayer, 1990). This indicates that strengthening students' intrinsic motivation and social awareness serves as a fundamental prerequisite for activating their agency within the social context (Vallerand, 2000).furthermore, the results of the Delphi and Kendall's W analysis confirmed that architectural experts share a strong consensus on the necessity of these critical factors, supporting the structural validity of the refined conceptual model. Subsequently, four implementable educational strategies were proposed and prioritized using the TOPSIS method. The final ranking indicated that Alternative A4, which focuses on extra-curricular workshops and short-term community-based interventions, achieved the highest score. This result shows that direct engagement with real social environments offers the greatest potential to foster activist behavior, enhance communication skills, strengthen social self-efficacy, and improve environmental and social awareness among students (Harryman 2nd et al., 1991; Jones, Petrescu, and Till, 2013). Alternative A3, which promotes the progressive refinement and development of Design Studio syllabi (Design I–V), ranked second due to its

ability to institutionalize activist values within the core curriculum and foster cumulative and long-term learning outcomes. Alternative A2 ranked third, as adding a dedicated chapter in Design IV and V enables exposure to real-world complexities; however, its impact is limited to only a portion of the design curriculum, reducing the continuity and depth of the learning experience. Finally, Alternative A1, developing a two-credit elective course on design activism, received the lowest ranking. The elective nature of this strategy means that only a small proportion of students benefit from such initiatives, resulting in weaker integration with the mainstream design education process.

Overall, the results show that experiential and socially engaged educational interventions (A4 and A3) are considerably more effective than strategies that remain primarily conceptual or limited within the existing educational structure (A2 and A1) (Schön, 2017; Tokman and Yamacli, 2007).

Discussion

The discussion of this study emphasizes the critical role of activism competencies in shaping architects who are socially responsible toward their communities. Integrating quantitative prioritization (NNLS and TOPSIS) with expert-driven validation demonstrated that strengthening students' critical questioning skills, personal motivation, and emotional intelligence is essential for improving their capacity for social engagement and responsible design decision-making. These findings align with contemporary architectural education literature, which asserts that design studios must evolve beyond form-centered exercises to cultivate civic awareness, ethical judgment, and an understanding of the social consequences of architectural decisions. The prioritization results revealed that experiential and community-oriented approaches have the greatest impact on activism-based learning. The highest ranking of Alternative A4 confirms that direct interaction with real stakeholders and real-world contexts enables deeper comprehension of social and environmental challenges while enhancing students' sense of agency and responsibility. This aligns with the global shift toward participatory design studios, live projects, and problem-based learning embedded within authentic social environments. The second-ranked strategy (A3) highlights the importance of gradually internalizing activism concepts within the formal curriculum. Integrating activism progressively across the design studio sequence fosters continuous and cumulative learning—overcoming a well-documented limitation of elective courses, which often lack sustained educational influence.in contrast, Alternatives A1 and A2—which rely mainly on complementary theoretical or partial curricular additions—ranked lower due to their limited reach and weaker alignment with the core design culture. Their supplemental nature restricts the extent of behavioral change achieved among students. Thus, the results indicate that advancing activism-oriented architectural education requires structural transformation, not merely the addition of theoretical content. Ultimately, these findings

underscore the need for a pedagogical shift from a product-centered studio culture to a process-oriented and socially engaged learning approach, wherein architecture students become not only spatial designers but also informed actors aware of the social and environmental implications of design.

Practical and Educational Implications

- Gradual integration of activism-related concepts within the syllabus of Design Studios I–V
- Establishing institutional collaborations with local communities and civic organizations
- Enhancing real-world engagement through projects based on user and societal needs
- Supporting faculty development in teaching activism-oriented design approaches
- Allocating institutional resources and incentives for community-based design practices
- Developing performance-based assessment tools to evaluate students' activist skills
- Promoting interdisciplinary studio practices (e.g., collaboration with sociology, environmental studies, and urban management

Limitations

- Limited number of experts (n = 10), potentially affecting generalizability
- Focus on the architecture education system of Iran, which may differ across regions
- Lack of experimental implementation of the proposed strategies in actual design studios

Future Research Directions

- Pilot implementation of selected strategies in design studios to evaluate real educational outcomes
- Expanding the expert sample to include international and interdisciplinary perspectives
- Developing supervised AI-based models to predict students' readiness for activism-oriented learning
- Long-term evaluation of the influence of activism education on graduates' professional behavior
- Investigating institutional challenges and barriers to curriculum reform toward activist pedagogy

Conclusion

This study developed and validated a comprehensive model for enhancing activism-oriented architectural design education through a mixed-methods approach. After identifying forty key influencing factors from qualitative research, expert consensus was established through three rounds of Delphi analysis, followed by quantitative weighting using NNLS regression. The findings revealed ten major factors with the greatest influence on students' activist learning. Based on these key factors, four feasible educational strategies were formulated and prioritized by applying the TOPSIS method. The prioritization results highlighted that experiential and community-based interventions offer the highest educational value in strengthening activism competencies within architectural design studios. These results emphasize the need for a

pedagogical shift toward socially engaged and participatory learning environments, enabling students to understand the broader societal and environmental implications of design. Overall, this research transforms the conceptual model into a practical decision-making framework for curriculum development and policy enhancement. It provides a clear roadmap for integrating activism competencies into architectural education and lays the foundation for future development of supervised AI-based models to evaluate students' readiness for activism-oriented learning.

Author Contributions

Conceptualization, M.B.; methodology, M.B.; data collection, M.B.; statistical analysis, M.B.; formal analysis, M.B.; writing – original draft, M.B.; supervision, P.A.; writing – review & editing, P.A.; validation, M.M.; writing – review, M.M. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data supporting the findings of this study are not publicly available due to confidentiality agreements with expert participants. However, the datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request, for qualified research purposes.

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Ethical considerations

This study was conducted in accordance with recognized ethical standards for research involving human participants and in line with COPE guidelines. Participation in the expert survey was voluntary, and all respondents were informed about the purpose of the study and consented to contribute anonymously. Personal identities and institutional affiliations of expert participants were kept confidential to ensure privacy and data protection. According to institutional regulations, formal ethics committee approval was not required because the study involved voluntary expert opinion from adult participants, with no collection of personal sensitive data. The authors confirm that no data fabrication, falsification, plagiarism, or research misconduct occurred during the study.

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Conflict of interest

The authors declare no conflict of interest.

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