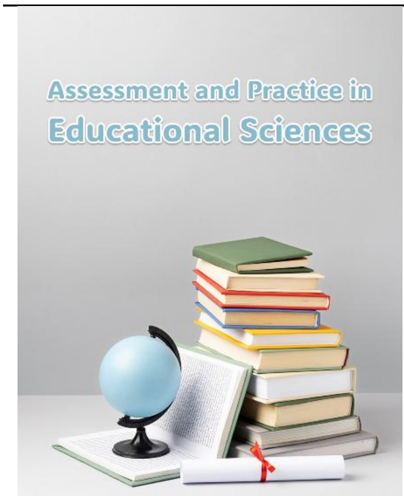
Assessment and Practice in Educational Sciences



Developing a Model of Citizenship Education in Smart Cities

1. Zahra. Gholami: PhD Student, Department of Educational Management, Science and Research Branch, Islamic Azad University, Tehran, Iran.

2. Hamideh. Reshadatjoo*: Associate Professor, Department of Crisis Management and Urban Management, Science and Research Branch, Islamic Azad University, Tehran, Iran. (Email: reshadatjoo@srbiau.ac.ir)

3. Afsaneh. Zamani Moghadam: Associate Professor, Department of Educational Management, Science and Research Branch, Islamic Azad University, Tehran, Iran.

Article type:
Original Research

Article history:
Received 13 October 2024
Revised 06 December 2024
Accepted 08 December 2024
Published online 10 December 2024

How to cite this article:
Gholami, Z., Reshadatjoo, H., & Zamani Moghadam, A. (2024). Developing a Model of Citizenship Education in Smart Cities. *Assessment and Practice in Educational Sciences*, *2*(4), 1-19. https://doi.org/10.61838/japes.153

ABSTRACT

The present study was conducted with the aim of developing a model of citizenship education in smart cities. From the perspective of its purpose, this study is a fundamental–applied research. In terms of data, it used a mixed-methods design, and regarding its implementation method, it followed a grounded theory approach (based on interviews with experts). In the quantitative phase, survey models were employed to collect research data. The qualitative population consisted of academic experts and senior managers of the municipalities of Tehran, Tabriz, and Mashhad. A purposive non-random sampling method was used, and according to the principle of theoretical saturation, 20 participants were selected as the qualitative sample. The quantitative population included 68,000 managers and employees of the Tehran Municipality. To determine the sample size for the quantitative phase, Cochran's formula was applied, resulting in a sample of 380 managers and employees of Tehran Municipality. A multistage cluster sampling technique was used for sample selection in the quantitative phase. In the qualitative section, semi-structured in-depth interviews were conducted, and in the quantitative section, a researcher-developed questionnaire was utilized. To ensure the validity of the instruments in the qualitative phase and to verify the accuracy of findings from the researcher's perspective, the opinions of university professors and domain specialists were employed. The reliability of the interviews was established using the test–retest method and inter-subject agreement. For determining the validity of the questionnaire, face validity, content validity, and construct validity were examined. Reliability was assessed through Cronbach's alpha and composite reliability, both of which were confirmed. Data analysis in the qualitative phase was performed using theoretical coding. In the quantitative phase, based on the research questions, descriptive statistics (mean, standard deviation, skewness, and kurtosis) were analyzed using SPSS version 21, while inferential statistics—including Pearson correlation and confirmatory factor analysis—were performed using SPSS-V21, SMART PLS-V2, and LISREL-V8 software packages. The results of the study indicated that citizenship education in a smart city encompasses dimensions such as educational objectives, content, and evaluation. Moreover, the factors influencing citizenship education in smart cities include dimensions of support and information technology, while the outcomes of citizenship education were identified as increased literacy and civic participation. In conclusion, a conceptual model was developed based on the grounded theory approach, which demonstrated acceptable validity.

Keywords: Citizenship education, Smart cities, Information technology, Support

Introduction

In the twenty-first century, the notion of a *smart city* has become an essential paradigm in urban development, reflecting the integration of technology, governance, and citizenship toward sustainable and inclusive growth. The concept is not merely about embedding digital infrastructure into the physical and administrative fabric of cities; it represents a profound shift in how urban environments are designed to enhance human experience and civic engagement. Smart cities seek to align technological innovation with human-centered design, ensuring that citizens become active participants in shaping the future of their communities rather than passive recipients of services (1). This transformative perspective emphasizes the role of education, governance, and participatory mechanisms in developing responsible, informed, and empowered citizens.

At the heart of smart city development lies the principle of *citizenship education*, which extends beyond conventional schooling to encompass digital literacy, civic responsibility, and participatory awareness. Citizenship education in the context of smart cities serves as a dynamic instrument to equip individuals with the knowledge, skills, and attitudes necessary to engage effectively in technologically mediated governance structures. The adoption of digital technologies within urban systems has redefined the relationship between citizens and institutions, fostering new forms of civic participation and shared decision-making (2). According to the Unified Smart City Model proposed by (1), sustainable urban ecosystems are contingent upon the integration of social, institutional, and technological dimensions—each of which demands a well-informed and educated citizenry capable of utilizing digital tools responsibly.

However, the mere deployment of technology does not guarantee the emergence of a smart society. As (3) emphasizes, ethical and institutional frameworks play a crucial role in shaping the adoption and functionality of smart city initiatives. Without a citizen-centered educational model, smart technologies may exacerbate inequalities, limit inclusivity, and generate governance gaps. The “adoption gap” in smart cities arises when digital infrastructures are developed without parallel efforts to educate citizens about their civic and ethical responsibilities within these systems. Thus, embedding citizenship education into smart city planning ensures that technological advancements contribute to social equity, transparency, and participatory democracy.

In Iran and other developing contexts, the emergence of smart city initiatives has introduced new challenges and opportunities for urban management. As (4) argues, civic education directly influences the quality of urban life by shaping citizens’ understanding of their roles in maintaining public welfare, adhering to civic norms, and participating in governance. This perspective aligns with the global recognition that education is a fundamental determinant of social sustainability and that smart citizenship cannot be achieved solely through technological means. The integration of educational and technological strategies must be deliberate, systematic, and context-sensitive to local governance structures (5).

A critical review of the literature reveals that the transition to smart cities necessitates a redefinition of both urban management and civic participation. The digitalization of municipal operations, exemplified by e-learning platforms and electronic governance systems, has demonstrated measurable effects on administrative efficiency and civic engagement (6). These transformations underline the importance of cultivating digital citizenship—a concept that combines technical competence with ethical awareness and social responsibility. As (7) notes, the concept of *digital citizenship* requires education systems to adapt curricula that promote safe, informed, and participatory online behaviors, ensuring that citizens contribute constructively to digital societies.

In this regard, (8) highlights an important dimension of inclusivity by examining the digital divide affecting vulnerable groups, including individuals with disabilities. The success of smart city initiatives depends on equitable access to digital resources and education, making it imperative to design adaptive programs that bridge technological disparities. Smart cities that neglect such inclusive principles risk marginalizing portions of their population and undermining the very foundations of civic equality and participation.

Furthermore, the construction of an informed and participatory citizenry within a smart urban ecosystem requires alignment between technological innovation and pedagogical design. (9) emphasizes that empowering a learning culture is central to identity formation and civic engagement in higher education, a notion that extends to lifelong learning frameworks essential for urban populations. Similarly, (10) underscores the importance of quality management in education as a mechanism for developing human resources capable of adaptive learning and collaborative problem-solving—skills that are indispensable in smart urban contexts.

In the context of Iranian urban systems, the necessity of integrating educational strategies into smart governance is particularly pressing. As (11) argues, developing an electronic city model is a prerequisite for achieving smart governance and responsive administration. This transformation depends not only on technical infrastructures but also on educational interventions that promote technological literacy and civic responsibility. The ultimate goal is to enable citizens to interact effectively with digital platforms, understand data-driven decision-making processes, and engage in co-creation of public services.

From a sociological standpoint, (12) proposed a model for training professional citizens within higher education systems, emphasizing the competencies required in the third millennium—critical thinking, ethical reasoning, and social accountability. These competencies, when embedded within the educational fabric of smart cities, foster a proactive and responsible urban culture. The same principle underpins the curriculum design recommendations by (13), who highlighted the need for aligning social studies education with the goals of social citizenship. Such educational alignment ensures that citizenship training begins early and continues across life stages, reinforcing democratic and participatory values in the urban context.

The international literature echoes similar concerns. (14) found that teachers' understanding of diversity in citizenship education plays a significant role in fostering inclusive learning environments that prepare individuals for civic participation in pluralistic societies. In line with this, (15) emphasized that effective citizenship education requires institutional support and coherent leadership to translate educational policies into meaningful practices. When these frameworks are embedded within smart cities, they not only strengthen civic identity but also encourage citizens to contribute actively to technological and social innovation.

Moreover, the complexity of smart city governance demands systems thinking and interdisciplinary collaboration. As (16) observed, organizations often reduce complexity by creating new forms of structured complexity, enabling them to adapt to dynamic environments. Smart cities must therefore develop educational systems that prepare citizens to navigate such environments—systems that foster adaptive learning, cross-sectoral collaboration, and data-driven decision-making. (17) adds that psychological empowerment and organizational citizenship behavior—core outcomes of effective learning environments—are vital for sustaining engagement and accountability in large-scale institutional settings such as municipalities.

Empirical studies conducted in recent years reinforce the growing interdependence between smart city development, education, and citizen participation. For instance, (18) demonstrated through comparative analysis that the success of smart cities depends heavily on citizen participation and co-governance mechanisms. Similarly, (2) provided systematic evidence that smart city applications promoting participatory governance enhance transparency, trust, and civic engagement. These findings underscore the necessity for educational systems that train citizens not only to use smart technologies but also to engage critically with them, shaping policies and practices that align with public interests.

From a managerial perspective, (19) proposed a data-driven strategic roadmap for developing smart citizens, highlighting the integration of analytics and educational strategies in fostering participatory governance. This approach aligns with the growing trend toward evidence-based policymaking and digital competency frameworks. Similarly, (20) emphasized the role of smartphones and mobile technologies in shaping urban perception and civic engagement, suggesting that education must address the cognitive and behavioral implications of mobile connectivity.

These discussions collectively converge on the necessity of constructing a comprehensive model of *citizenship education in smart cities*—a model that integrates social, technological, and educational dimensions. Such a model must address the interplay between digital literacy, civic values, and participatory culture while ensuring inclusivity across socio-economic and demographic divides. It should also emphasize the importance of ethical frameworks, as the widespread adoption of smart technologies raises questions about privacy, accountability, and data governance (3).

In addition, the evolution of educational frameworks toward smart citizenship requires rethinking the curriculum, pedagogy, and evaluation systems to reflect the realities of digital societies. Educational programs must evolve from traditional classroom-based instruction to dynamic, experiential learning models that incorporate simulation, digital collaboration, and problem-based learning. As (9) and (10) note, cultivating a learning culture requires institutional commitment to continuous innovation and human development.

Building upon these theoretical and empirical foundations, the current study seeks to bridge the gap between technological advancement and human development by designing a context-sensitive framework for citizenship education in smart cities. The literature consistently shows that educational systems, when aligned with digital and governance infrastructures, play a pivotal role in enhancing civic engagement, equity, and resilience (2, 4, 8). This synergy ensures that citizens are not only technologically capable but also socially responsible and civically empowered.

In sum, the shift toward smart cities redefines education as a cornerstone of urban innovation. Developing a model of citizenship education suitable for smart cities involves an integrated approach that considers technological literacy, civic participation, ethical awareness, and inclusive governance. These components together constitute the foundation of sustainable smart urbanism—one in which citizens actively co-create the social and digital infrastructures of their communities.

Therefore, the aim of this study is to develop a comprehensive model of citizenship education for smart cities that integrates technological, educational, and participatory dimensions to enhance civic engagement and social sustainability.

Methods and Materials

This study is classified as a fundamental–applied research, aimed at addressing a practical problem and ultimately obtaining information that can assist in administrative and even individual decision-making processes. From the perspective of data type, the research adopts a mixed-methods design, incorporating both qualitative and quantitative approaches. By engaging domain experts, the study explores the dimensions, components, and indicators of a citizenship education model in smart cities. In terms of implementation, the researcher employed a grounded theory approach (interviews with experts) alongside survey-based quantitative methods, collecting data in two distinct phases: qualitative and quantitative.

The qualitative population of the study included academic experts and senior managers of the municipalities of Tehran, Tabriz, and Mashhad. The quantitative population consisted of managers and employees of the Tehran Municipality. The municipality includes 16 general departments and nine deputy offices, with a total of approximately 68,000 managers and employees.

In the qualitative phase, a purposive non-random sampling method was applied, with 20 participants selected according to the principle of theoretical saturation. To determine the sample size for the quantitative phase, Cochran's formula was used, resulting in a sample of 380 managers and employees from the Tehran Municipality. A multistage cluster sampling technique was utilized to select the participants. This method is particularly appropriate when the target population is very large, when no comprehensive list of members is available, or when the members are geographically dispersed and thus not easily accessible. In such cases, several districts or regions are randomly selected, and within the chosen cluster, random sampling is performed to select participants (Hafeznia, 2008).

In the present study, based on the multistage cluster sampling method, seven municipal regions in Tehran were randomly selected as the first-level clusters. Within these, the following departments were chosen as second-level clusters: the Mayor's

Office, the General Directorate of Performance Evaluation and Management Improvement, the General Directorate of Human Resources, the General Directorate of Managerial Assessment, the General Directorate of Budget and Planning, the Directorate of Welfare, Cooperation, and Social Services, and the General Directorate of Associations and Organizations. Within each selected department, managers and employees were randomly selected. All participants (male and female managers) took part in the study.

In the qualitative phase, semi-structured in-depth interviews were conducted. For data collection in the quantitative phase, two methods were employed:

1. Library Research: To identify and develop the conceptual model, existing literature on municipal education models in smart cities and related scientific papers, books, credible databases, and academic theses were reviewed.
2. Questionnaire: To collect the necessary quantitative data and verify its accuracy, a researcher-developed questionnaire derived from the codes obtained in the qualitative phase was administered. The questionnaire contained 138 close-ended items rated on a five-point Likert scale, covering the components of the citizenship education model for smart cities. It was completed by managers and employees of the Tehran Municipality.

To ensure the **validity** of instruments in the qualitative phase and the accuracy of the findings, feedback was obtained from academic professors and domain experts familiar with this research area. Simultaneously, participant validation was used during data analysis and interpretation to enhance credibility.

Reliability refers to the consistency of research findings. In qualitative interviews, reliability depends on the conditions of the interview, transcription, and analysis. Interviewee reliability also relates to the guidance and clarity of the questions. For transcription reliability, intra-subject consistency was ensured by having two individuals perform and compare transcription accuracy. During interview categorization, intercoder agreement percentages between two coders were calculated to assess reliability. An intercoder agreement rate of 60% or higher was considered acceptable. In the present study, test–retest reliability and intercoder agreement methods were employed to determine interview reliability (Delavar, 2017).

To assess questionnaire validity, face validity, content validity, and construct validity were examined. For face validity, questionnaires were reviewed by several sample members and academic experts before distribution. For content validity, the Content Validity Ratio (CVR) and Content Validity Index (CVI) were computed using evaluations from ten experts (including interview participants, academic specialists, and sample respondents). The CVI results showed that all questionnaire items met acceptable standards of simplicity, clarity, and relevance (CVI > 0.79). Similarly, CVR values for all items were greater than 0.62, indicating that no item required elimination.

For construct validity, convergent and discriminant validity were tested using SmartPLS version 2. Convergent validity results indicated that all factor loadings had significant t-values above 2.58 ($p < 0.01$), confirming that all items were significant at the 99% confidence level. All factor loadings exceeded 0.50, the Average Variance Extracted (AVE) for all components was greater than 0.50, and Composite Reliability (CR) for all constructs exceeded AVE, confirming convergent validity (Borg & Gall, 2019).

Discriminant validity was examined through the Fornell–Larcker criterion and cross-loading tests, both available in SmartPLS. Results showed that the square root of AVE for each latent variable exceeded its correlations with other constructs, and that each indicator's loading on its respective latent construct was at least 0.1 greater than its loadings on other constructs. Together, these findings confirmed discriminant validity.

Reliability was further assessed using Cronbach's alpha and Composite Reliability (CR). For all research variables, these coefficients exceeded 0.70, confirming the reliability of the measurement instruments. Given that Cronbach's alpha and CR values were above 0.7 and AVE exceeded 0.5, the measurement model demonstrated acceptable internal consistency. The results also confirmed convergent validity (CR > 0.7, CR > AVE, AVE > 0.5) and discriminant validity (MSV < AVE, ASV < AVE).

In the qualitative phase, data were analyzed through theoretical coding, which involves breaking down, conceptualizing, and reassembling data in new ways to generate theory directly from data. This process relies on three fundamental elements: concepts, categories, and propositions. The grounded theory thus emerges from raw data (Delavar & Koushki, 2013, p. 179).

Data analysis represents the core process of theory generation in grounded research. Throughout the study, data collection, organization, and analysis were interdependent processes. For qualitative data (interviews and theoretical foundations), three types of coding were employed:

- Open coding
- Axial coding
- Selective coding

In the quantitative phase, both descriptive and inferential statistical methods were used.

Demographic characteristics derived from the questionnaire were described using percentages, frequencies, tables, figures, and charts. The research variables were described using means, standard deviations, skewness, and kurtosis. Descriptive analyses were conducted using SPSS version 21. For inferential analyses, Pearson correlation and confirmatory factor analysis (CFA) were performed using SPSS-v21, SmartPLS-v2, and LISREL-v8 software packages.

Findings and Results

Question 1: What are the dimensions, components, and indicators that constitute citizenship education in smart cities?

Question 2: What are the dimensions, components, and indicators that influence citizenship education in smart cities?

Question 3: What are the outcomes of citizenship education in smart cities?

To address these research questions, theoretical coding was employed. In practice, analysis of responses collected from expert interviews provided the answers to these questions. MAXQDA software—a professional application for analyzing data gathered through qualitative and mixed-methods procedures—was used for this purpose.

Table 1: List of Concepts Extracted from Semi-Structured Interviews

Construct	Selective coding	Axial coding	Open coding (indicator)	Interviewee code
Citizenship education in the smart city	Educational objectives	Needs assessment	Surveying opinions about implementing training	I10, I6, I5, I1, I7
			Monitoring the training needs of municipal managers and employees	I1, I2, I15
			Developing formal and informal training programs	I3, I5, I2, I11
			Assessing municipal facilities for implementing training	I3, I4, I11, I5
			Seeking assistance from municipal managers and stakeholders for educational needs assessment	I3, I8, I3
		Alignment with individual differences	Consistency of the citizenship education program with individuals' differences	I2, I6, I10, I2
			Attention to the municipality's social culture	I11, I9, I10, I2, I5
			Knowledge-oriented training	I6, I1, I1
			Attention to the number of managers and employees receiving citizenship education	I8, I15, I3, I2
		Flexibility	Flexibility of training relative to the environment	I5, I11, I4, I1

			Considering managers' and employees' receptivity to the training program	I1, I2, I3, I7, I5
			Granting employees autonomy to choose the type of citizenship training	I8, I7, I11, I5
			Allowing managers and employees to learn in locations beyond the workplace	I7, I3, I5, I17
			Implementing training based on available technological equipment	I1, I9, I1
Content	Challenge orientation	—	Organizing instructional content based on municipal needs	I6, I7, I5, I7
			Attractiveness of instructional content	I10, I3, I18, I2
			Encouraging managers and employees to participate in trainings	I11, I8, I4, I9
			Motivating inquiry and research by recognizing citizenship education within the municipality	I4, I2, I6
			Challenging current issues by providing practical content	I4, I2, I8, I15, I9
			Inviting managers and employees to participate in selecting instructional content	I8, I2, I3, I1
			Providing appealing and challenging content aligned with job roles	I11, I1, I15, I8, I6
	Accessibility	—	Availability of appropriately tailored training programs	I6, I8, I10, I17, I4
			Provision of required information technology for implementing citizenship education	I10, I8, I1, I3, I4
			Ease of using course content as a factor in promoting learning	I3, I1, I5, I2, I16
			Equitable provision of virtual facilities to managers and employees	I2, I6, I10, I2
Evaluation	Alignment of measurement with objectives, content, and resources	—	Informal evaluation of delivered training consistent with citizenship-education objectives	I6, I9, I3, I5
			Assessment to enhance learning	I2, I1, I10, I7
			Comparing delivered content with principles of career-aptitude identification	I4, I2, I8, I5, I9
	Clarity and transparency of criteria	—	Defining learning criteria	I8, I2, I19, I1
			Adjusting learning-assessment criteria according to delivered content	I11, I3, I5, I9
			Transparency in assessing managers' and employees' performance	I8, I7, I11, I18
			Evaluating based on performance and competency rather than statements during training	I7, I9, I3, I8
	Use of assessment methods	—	Use of active assessment methods	I1, I9, I1
			Teaching self-assessment as the key step in program evaluation	I6, I7, I5, I2
			Raising awareness of various methods for evaluating trainings	I8, I7, I11, I18
			Implementing formative assessment	I7, I3, I9, I17
			Using traditional assessment alongside other assessments	I6, I7, I5, I7
			Assessing behavioral change influenced by the citizenship education program	I10, I3, I18, I2
	Flexible evaluation and assessment	—	Flexible measurement	I7, I5, I1, I7
			Context-based evaluation	I11, I2, I3, I9
			Evaluation based on provided educational facilities	I7, I5, I1, I7
Factors affecting citizenship education	Support	Managerial support	Attention of municipal managers to training	I2, I6, I10, I2

			Allocation of sufficient budget for citizenship education	I6, I19, I3, I5
			Provision of necessary facilities for citizenship education	I2, I1, I10, I7
	Support	Legal support	Making citizenship education mandatory in the municipality	I4, I2, I8, I15, I9
			Attention to upstream legal documents	I8, I2, I19, I1
			Aligning trainings with citizenship laws	I10, I2, I3, I9
	Smart social institutions	—	Assisting the municipality to offer programs based on social approaches	I8, I7, I11, I18
			Cooperation with nongovernmental social institutions	I7, I9, I3, I17
			Allocating budget for cooperation between social institutions and the municipality	I1, I9, I1
Information technology	Availability	—	Availability of technological tools for employees and managers	I6, I7, I5, I7
			Possibility of using educational tools in the workplace	I8, I7, I11
			Possibility of using educational tools in the living environment	I7, I3, I9, I3, I17
	Up-to-dateness	—	Updating modern technologies in the municipality for citizenship trainings	I6, I5, I7
			Using experienced experts for training	I10, I2, I18, I2
			Updating existing technologies based on training content	I2, I6, I10, I2
	Ease of use	—	Easy use of educational tools	I6, I19, I3, I5
			Easy training for all employees and managers	I2, I1, I10, I7
			Ease of using technologies for less-experienced employees	I4, I2, I8, I15, I9
Outcomes of citizenship education	Literacy growth	Political literacy	Knowledge transfer	I8, I2, I19, I1
			Political skills	I10, I2, I3, I9
			Transfer of political knowledge	I8, I7, I11, I18
	Literacy growth	Civic literacy	Volunteering to participate in civic associations	I7, I9, I3, I17
			Skills for appropriate behavior with colleagues	I1, I19, I1
			Emphasis on realizing civil society	I6, I7, I5, I7
	Literacy growth	Citizenship literacy	Socialization	I8, I20, I11
			Quality of life	I7, I13, I9, I3, I18
			Citizenship culture	I6, I5, I7
	Participation	Social participation	Engaging individuals	I10, I2, I18, I2
			Learning through participatory approaches	I2, I16, I10, I2
			Voluntary behavior	I2, I6, I10, I2
	Participation	Community cohesion	Justice	I6, I19, I3, I5
			Equality	I2, I11, I10, I7
			Power and authority	I4, I2, I8, I15, I99
			Unity and commitment	I8, I2, I19, I20
			Personal obligation to seek justice	I10, I2, I3, I9
	Participation	Pluralism	Freedom	I8, I7, I11, I18
			Diversity	I7, I9, I3, I17
			Personal privacy	I1, I20, I1
			Personal rights	I6, I7, I5, I7
			International rights	I8, I7, I11

Strategies	—	Managerial strategy	Managers' support for implementing citizenship education	I6, I8, I10, I17, I4
			Allocating the necessary budget to implement the program	I10, I8, I1, I3, I4
			Provision of educational facilities by managers	I3, I1, I5, I2, I16
			Securing consensus among managers and key individuals	I2, I6, I10, I2
			Managers' resolve to deliver citizenship education	I6, I9, I3, I5
	—	Organizational factors	Attention to decentralization in decision-making about trainings	I2, I1, I10, I7
			Reducing formalization in the municipality	I4, I2, I8, I15, I9
			Reducing job complexity when providing need-based trainings	I8, I2, I19, I1
			Attending to employees' and managers' performance in educational programs	I2, I3, I9
	—	Individual factors	Individuals' enthusiasm for learning	I8, I7, I11, I18
			Trainers' enthusiasm for structured citizenship education	I7, I3, I9, I3, I17
			Individuals' attention to their own educational needs	I1, I9, I1
			Employees' articulation of educational needs	I6, I7, I5, I1
			Creating motivation toward education	I8, I7, I11, I18
			Effort to implement effective training	I7, I3, I9, I17
			Strengthening the learning culture in the municipal community	I6, I7, I5, I7
	—	Educational factors	Instructors' familiarity with work environments and the necessity of citizenship education	I10, I3, I18, I2
			Enhancing instructors' skills	I7, I5, I1, I7
			Skill in delivering intended content	I11, I3, I2, I9
			Knowledge of instructional aids	I7, I5, I1, I7
			Providing technological infrastructure for high-quality delivery	I6, I8, I10, I17, I4
			Attention to instructional design by educational managers	I10, I8, I1, I3, I4
			Aligning learning environments with social and occupational contexts	I3, I1, I5, I2, I16
			Emphasis on applicability of citizenship education	I2, I6, I10, I2
			Attention to motivational components in curriculum-related trainings	I6, I9, I3, I5
			Attention to educational interaction	I2, I1, I10, I7
Facilitators	—	Educational factors	Availability of educational facilities	I4, I2, I8, I15, I9
			Having an educational budget for the program	I8, I2, I19, I1
			Support for citizenship trainings	I10, I3, I2, I9
			Attention to in-service learning in organizations	I8, I7, I11, I18
			Support from municipal managers	I7, I3, I9, I1, I5
			Allocation of technological educational facilities to citizenship trainings	I1, I9, I1
	—	Organizational factors	Reducing centralization in organizations	I6, I7, I5, I1
			Organizational demand for educational credentials	I8, I7, I11, I18
			Attention to knowledge sharing within the municipality	I7, I3, I9, I3, I17

			Attention to knowledge produced in the organization	I6, I7, I5, I7
	—	Attitudinal factors	Organizational sense of need for growth	I10, I3, I18, I2
			Individuals' commitment and accountability toward learning	I7, I5, I1, I7
			Diagnosing learning challenges in the community	I11, I3, I2, I9
			Providing rational responses regarding learning and its environment	I7, I5, I1, I7
	—	Individual factors	Greater perceived need for citizenship growth	I6, I8, I10, I17, I4
			Promotion of a learning culture	I10, I8, I1, I3, I4
			Individuals' motivation to know	I3, I1, I5, I2, I16
			Individuals' willingness to participate	I2, I6, I10, I2
Barriers	—	Educational barriers	Lack of professional instructors	I6, I19, I3, I5
			Lack of creativity in delivering trainings	I2, I1, I10, I7
			Insufficient attention to individuals' needs	I4, I2, I8, I15, I9
			Trainings not being job-oriented	I8, I2, I19, I1
			Lack of attention to a knowledge-creation-based curriculum	I10, I2, I3, I9
	—	Managerial barriers	Insufficient attention and support by managers for a new curriculum	I8, I7, I11, I18
			Failure to allocate adequate budget	I7, I9, I3, I17
			Lack of attention to technological educational tools	I1, I9, I1
			Neglect of social and economic development in training design	I6, I7, I5, I7
			Lack of attention to progress and social development	I8, I7, I11
	—	Individual barriers	Lack of attention to the value-orientation of trainings	I7, I3, I9, I3, I17
			Insensitivity to training quality	I6, I5, I7
			Absence of critical review of the dimensions and values of trainings	I10, I2, I18, I2

Question 4: How are the indicators of citizenship education in smart cities prioritized and weighted?

Question 5: What model can be proposed for citizenship education in smart cities?

To answer the above questions, confirmatory factor analysis (CFA) was used.

Before conducting factor analysis, given that the measurement scale was interval and the data distribution was normal, appropriate parametric tests (Pearson correlation) were applied.

Table 2. Correlations among Factors

Category	Subcategory	Statistic	Constituent factors
Influencing factors	Support	Correlation	0.562**
		Sig.	0.000
	Technology	Correlation	0.525**
		Sig.	0.000
Outcomes	Literacy growth	Correlation	0.526**
		Sig.	0.000
	Participation	Correlation	0.479**
		Sig.	0.000

As shown in Table 2, the symbol ** indicates that the correlations among the study variables are significant at the 0.01 level, meaning there is a direct relationship between the variables.

The model of influencing factors is measured by 18 items. Standardized parameter estimates show that all indicators are statistically significant and have high factor loadings. The fit indices indicate a satisfactory model fit. In addition, factor loadings were used to prioritize indicators, and the mean of factor loadings was used to prioritize components and dimensions.

Table 3. Approved Items for Influencing Factors

Dimension	Priority	Component	Code	Priority	Item label	Factor loading	t-value	Item status	Priority
Support	2	Managerial support	G_Modiran	3	G1	0.78	17.60	Approved	3
					G2	0.85	19.82	Approved	1
					G3	0.78	17.73	Approved	2
		Legal support	G_Ganuni	2	G4	0.83	19.33	Approved	2
					G5	0.85	20.06	Approved	1
					G6	0.82	19.11	Approved	3
		Smart social institutions	G_Nahad	1	G7	0.77	17.43	Approved	3
					G8	0.85	20.38	Approved	2
					G9	0.88	21.33	Approved	1
Information technology	1	Availability	G_Dastras	2	G10	0.88	21.59	Approved	1
					G11	0.85	20.35	Approved	3
					G12	0.88	21.46	Approved	2
		Up-to-dateness	G_Beruz	3	G13	0.84	19.93	Approved	2
					G14	0.83	19.68	Approved	3
					G15	0.84	20.15	Approved	1
		Ease of use	G_Sohulat	1	G16	0.89	21.87	Approved	2
					G17	0.90	22.10	Approved	1
					G18	0.83	19.44	Approved	3

All items had t-values greater than 1.96; therefore, none of the items were removed from the model. Moreover, the factor loading indicates each indicator's contribution to measuring its respective variable: indicators with higher loadings contribute more, while those with smaller coefficients contribute less to measuring the construct. The chi-square/df for the current model is 2.44, and RMSEA = 0.064.

The outcomes model is measured by 22 items. Standardized parameter estimates show that all indicators are statistically significant with high factor loadings. The fit indices indicate a satisfactory model fit.

Table 4. Approved Items for Outcomes

Dimension	Priority	Component	Code	Priority	Item label	Factor loading	t-value	Item status	Priority
Literacy growth	1	Political literacy	P_Siyasi	3	P1	0.82	19.08	Approved	2
					P2	0.82	18.98	Approved	3
					P3	0.88	21.25	Approved	1
		Civic literacy	P_Madani	1	P4	0.85	20.29	Approved	3
					P5	0.87	20.93	Approved	2
					P6	0.92	23.10	Approved	1
		Citizenship literacy	P_Shahrvandi	2	P7	0.84	20.10	Approved	3
					P8	0.88	21.34	Approved	2
					P9	0.89	21.97	Approved	1
Participation	2	Social participation	P_Mosharekat	2	P10	0.88	21.38	Approved	2
					P11	0.89	21.88	Approved	1
					P12	0.74	16.59	Approved	3
		Community cohesion	P_Etehad	3	P13	0.83	19.69	Approved	1
					P14	0.73	16.25	Approved	5
					P15	0.79	18.17	Approved	4
					P16	0.81	18.73	Approved	3
					P17	0.81	18.79	Approved	2
		Pluralism	P_Takasor	1	P18	0.86	20.56	Approved	2
					P19	0.85	20.53	Approved	3
					P20	0.87	21.21	Approved	1
					P21	0.84	19.95	Approved	4
					P22	0.77	17.51	Approved	5

All items had t-values greater than 1.96; therefore, none of the items were removed from the model. Moreover, the factor loading indicates each indicator's contribution to measuring its respective variable: indicators with higher loadings contribute more, while those with smaller coefficients contribute less to measuring the construct. The chi-square/df for the current model is 2.41, and RMSEA = 0.063. To address the research questions, a confirmatory structural equation model (SEM) was used. After specifying the structure, adding model constraints, and selecting the maximum likelihood estimation method, the model was executed and the path diagram with fit was obtained.

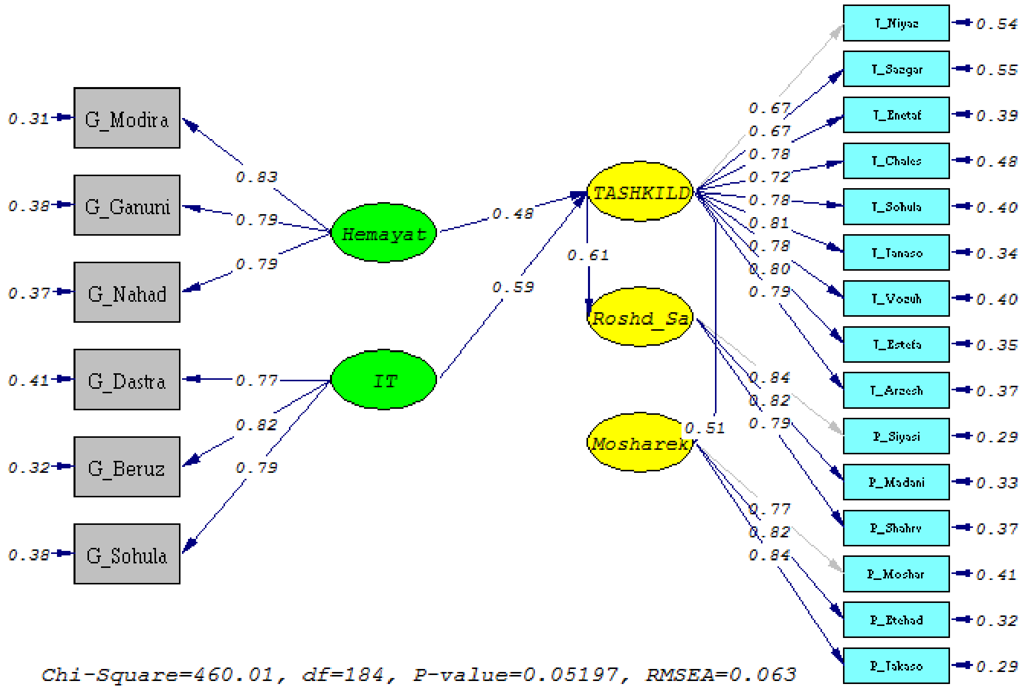


Figure 1. Main model with standardized coefficients

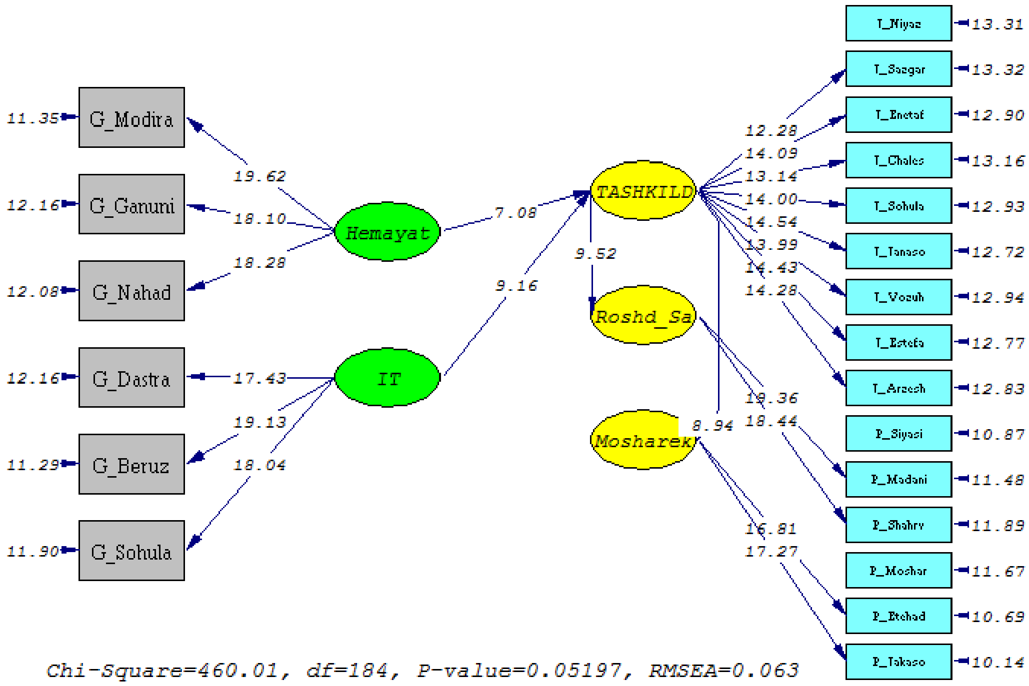


Figure 2. Main model with coefficient significance

As shown in the figures above, all parameter values related to the model—together with factor loadings and path coefficients—are presented. Given the standardized coefficients and the t-values depicted (t-values greater than 2.58), it can be inferred that direct relationships exist among the factors. As indicated by the chi-square and RMSEA indices, the model provides a better fit to the data. The model outputs are summarized in Table 5.

Table 5. Selected Key Fit Indices for the Specified Model

Class of index	Index name	Abbrev.	Value	Acceptable fit
Absolute fit	Covered area (chi-square)	—	460.01	—
	Goodness of Fit Index	GFI	0.99	> 0.90
Comparative fit	Adjusted Goodness of Fit Index	AGFI	0.96	> 0.90
	Comparative Fit Index	CFI	0.98	> 0.90
Parsimonious fit	Root Mean Square Error of Approximation	RMSEA	0.063	< 0.10

As can be seen, the model's fit indices are in a desirable range.

Table 6 presents the path coefficients along with their significance values. As observed, all paths are accepted.

Table 6. Path Coefficients, t-values, and Decisions

Path	Coefficient	t-value	Status
Support → Constituent factors	0.48	7.08	Approved
Information technology → Constituent factors	0.59	9.16	Approved
Constituent factors → Literacy growth	0.61	9.52	Approved
Constituent factors → Participation	0.51	8.94	Approved

Finally, based on the indicators and components identified from documentary evidence and expert interviews, and the analysis of quantitative data, the study's conceptual model—constructed using a grounded theory approach—is presented in Figure 3.

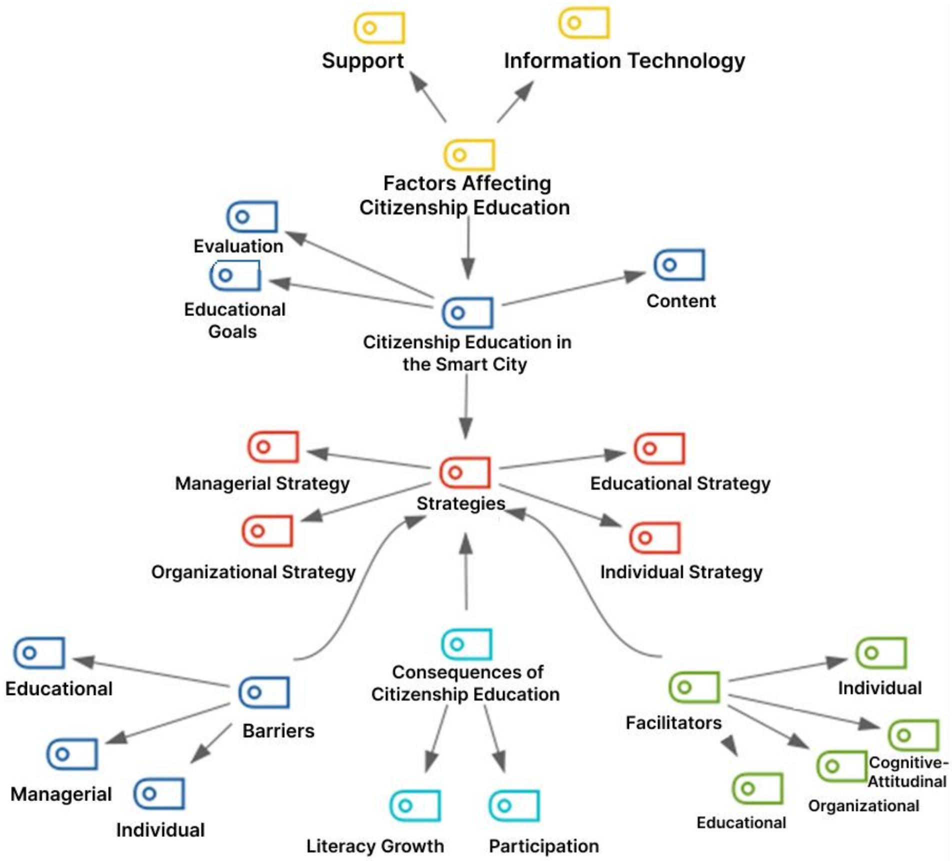


Figure 3. Final research model derived from qualitative and quantitative phases

Question 6: How appropriate is the model from the perspective of experts and specialists?

To evaluate the fit of the final model, a model assessment questionnaire was developed using a five-point Likert scale and distributed among 30 domain experts. The collected data were analyzed using a one-sample *t*-test, and the results are presented in Table 7.

Table 7. Results of One-Sample *t*-Test to Determine the Degree of Model Fit for the Proposed Final Model (Expected mean = 3)

No.	Item	Question	Mean	SD	*t*	*df*	Sig.
1	Consistency	Were the concepts derived from the analyzed data?	3.68	1.251	9.45	29	0.000
2	Comprehensibility	Are the concepts identifiable and systematically interrelated?	3.84	1.225	11.90	29	0.000
3	—	Are the categories well-formulated?	3.66	1.338	8.62	29	0.000
4	Generalizability	Has the theory been explained to account for variations under different conditions?	3.80	1.257	11.05	29	0.000
5	—	Have broader conditions that may affect the phenomenon under study been described?	3.70	1.185	10.27	29	0.000
6	Control	Do the theoretical findings appear significant?	3.64	0.885	12.64	29	0.000

The results indicated that for consistency, the calculated *t*-value (9.45) was significant at the 0.01 level. Comparing the mean of this model component (3.68) with the expected mean (3) shows that the model's consistency was validated by experts with 99% confidence.

For comprehensibility, the calculated *t*-value (11.82) was significant at the 0.01 level. Comparing the mean of this component (3.75) with the expected mean indicates that the comprehensibility of the model was confirmed by experts with 99% confidence. Regarding the comprehensibility items, the *t*-values for both questions were significant at the 0.01 level, and the observed means for each were higher than the expected mean (3); therefore, experts considered comprehensibility as a valid dimension of the model.

For generalizability, the calculated *t*-value (11.82) was significant at the 0.01 level. Comparing the mean of this component (3.75) with the expected mean indicates that the generalizability of the model was validated by experts with 99% confidence. For the two generalizability questions, the *t*-values were significant at the 0.01 level, and their observed means exceeded the expected mean (3); hence, experts considered generalizability to be a valid component of the model.

For control, the calculated *t*-value (12.64) was significant at the 0.01 level. Comparing the mean of this component (3.64) with the expected mean demonstrates that the controllability of the model was validated by experts with 99% confidence. Regarding the control items, the *t*-values for both questions were significant at the 0.01 level, and their observed means were higher than the expected mean (3); therefore, experts regarded control as a valid aspect of the model.

Discussion and Conclusion

The findings of the present study provided valuable insights into the structural dimensions, influencing factors, and outcomes of *citizenship education in smart cities*. The results confirmed that citizenship education within a smart city framework comprises three fundamental dimensions—educational goals, educational content, and evaluation—which together form the core structure of an educational model responsive to the demands of digital urban life. Moreover, the study identified information technology and organizational support as major influencing factors, while literacy growth and citizen participation emerged as the principal outcomes of such education. The use of confirmatory factor analysis further validated that all indicators had statistically significant factor loadings, confirming the robustness and internal consistency of the proposed model. These results collectively align with the conceptual foundation that citizenship education must integrate technological literacy, participatory competence, and ethical understanding in order to sustain the socio-technical ecosystems of smart cities (1, 8).

The identification of support and information technology as key determinants of effective citizenship education underscores the dual role of managerial commitment and digital infrastructure in facilitating civic learning. The strong path coefficients between these factors and the core structure of citizenship education indicate that the success of civic education initiatives in smart cities depends largely on institutional backing, resource allocation, and technological accessibility. These findings resonate with (4), who emphasized that civic education in urban management directly affects the quality of urban life and citizen participation. Similarly, (2) highlighted that digital applications within smart cities are most effective when supported by participatory governance structures and educational frameworks that empower citizens to engage with digital systems. The correlation between supportive governance and educational effectiveness also mirrors (12), who proposed that institutions play a decisive role in fostering citizenship competencies through structured educational programs in higher education systems.

The role of information technology as an enabler of citizenship education further confirms that technological access and literacy are prerequisites for civic empowerment in smart cities. The study found that dimensions related to the availability, usability, and up-to-date nature of technology were all positively associated with learning outcomes. This result aligns with (11), who argued that the development of electronic city infrastructures is a necessary precondition for establishing intelligent governance systems. (3) also noted that smart city projects require not only the deployment of advanced digital systems but also ethical and educational frameworks to ensure responsible and inclusive participation. In this respect, the study's findings highlight the need for equitable access to digital tools—a concern also raised by (8), who examined the implications of the digital divide for individuals with disabilities. These combined insights suggest that information technology acts both as a pedagogical medium and as a social equalizer, bridging gaps in access and enabling broader citizen participation in urban decision-making.

A significant outcome of the study was the identification of citizenship literacy as a primary consequence of smart city education. This dimension encompassed civic, political, and social literacy—each reflecting an enhanced understanding of rights, responsibilities, and participatory norms. Such findings are consistent with the theoretical view that education is the cornerstone of civic development. (15) demonstrated that structured citizenship education fosters civic identity and leadership within public schools, a principle that extends to the broader context of smart cities. Moreover, (9) emphasized that a culture of learning and identity formation is vital for empowering individuals to engage constructively within complex social environments. Together, these perspectives affirm that smart citizenship cannot be cultivated without educational mechanisms that foster critical thinking, digital ethics, and social accountability.

The second major outcome—citizen participation—further validates the theoretical assumption that knowledge and empowerment lead to action. The study revealed that educational interventions significantly increased civic engagement and collaborative behaviors within municipal settings. This aligns with the findings of (18), who reported that the success of smart cities depends primarily on active citizen participation rather than technological sophistication alone. Likewise, (2) found that digital participation tools, when coupled with educational programs, enhanced transparency and trust in local governance. The present study corroborates these findings by empirically confirming that education serves as the mediating mechanism between technological access and participatory behavior. Furthermore, the growth of citizen participation in the Iranian municipal context echoes the broader theoretical model proposed by (1), which views citizen engagement as a core performance indicator of smart city maturity.

The structural relationships revealed in the model also underscore the interplay between citizenship education, managerial strategies, and organizational learning. The model suggests that effective implementation of citizenship education depends on managerial flexibility, participatory leadership, and cross-departmental collaboration. These findings resonate with (10), who emphasized that quality management in education requires leadership commitment and systematic evaluation. In a similar vein,

(16) proposed that organizations facing complex environments must create structured complexity through adaptive systems—an idea mirrored in how municipalities manage multi-level educational initiatives. By integrating such managerial strategies into citizenship education, smart cities can create feedback-driven systems where learning outcomes inform policy and governance practices.

In terms of pedagogical design, the model validated education goals, content, and evaluation as the core structural components of citizenship education in smart cities. The importance of defining educational goals that align with civic and technological competencies supports earlier frameworks suggested by (13), who identified the misalignment between curriculum objectives and social citizenship education as a barrier to effective learning. Similarly, (14) highlighted that teachers' understanding of diversity and context significantly influences the implementation of inclusive citizenship education. The inclusion of flexible and technology-integrated content, as found in this study, echoes (7), who argued that digital citizenship requires continuous curriculum adaptation to reflect the evolving realities of online engagement and ethical digital behavior. The study's findings suggest that smart city education programs should focus on adaptability, interdisciplinarity, and inclusivity to prepare citizens for the fluid digital-urban environment.

The evaluation dimension in the model further demonstrates that continuous assessment, self-reflection, and feedback mechanisms are essential for maintaining the effectiveness of citizenship education. The study's use of confirmatory factor analysis to validate evaluative indicators mirrors the systemic approach advocated by (17), who linked psychological empowerment and organizational citizenship behavior to continuous feedback and learning environments. Evaluation in smart city education should not only measure cognitive outcomes but also assess civic engagement, ethical awareness, and participatory performance. This approach aligns with (10), who stressed the role of data-driven evaluation in human resource development and quality management.

The role of organizational and managerial support as a facilitating condition was particularly prominent. The study confirmed that municipal support in the form of funding, training, and policy reinforcement is indispensable for embedding citizenship education into the governance system. This finding echoes (12), who argued that higher education and governance institutions must collaborate to promote professional citizenship. Furthermore, the positive relationship between support structures and educational outcomes supports (5), who identified managerial inertia and lack of educational prioritization as major barriers in Tehran's urban management programs. These parallels affirm that structural support is not merely a contextual factor but a core determinant of educational success within complex urban systems.

Additionally, the findings highlighted the moderating effect of technological innovation on educational outcomes. The path analysis revealed that technological innovation amplifies the impact of educational content and goals by enhancing engagement and accessibility. This observation is consistent with (19), who proposed a data-driven strategic model for cultivating smart citizens through technological empowerment and analytics. (20) also demonstrated how mobile technologies influence citizens' perceptions of urban environments, underscoring the significance of mobile learning platforms and digital interfaces in promoting civic education. These convergent findings suggest that smart citizenship education must integrate adaptive technologies that facilitate experiential learning and real-time participation in governance processes.

The results also revealed that facilitators—including educational, organizational, individual, and attitudinal factors—enhance the effectiveness of citizenship education programs. This reinforces the notion that learning in smart cities is a multi-level process influenced by personal motivation, institutional support, and societal values. (9) and (10) both highlight the centrality of cultivating learning cultures where personal development and civic responsibility are interlinked. The presence of these facilitators suggests that citizenship education must be framed as a lifelong process rather than a time-bound intervention. Conversely, the study identified barriers such as insufficient professional training, limited innovation in teaching methods, and inadequate managerial attention—all of which constrain the scalability and impact of citizenship education. These findings are consistent with (13) and (5), who identified similar structural and pedagogical shortcomings in Iran's educational and municipal systems.

Overall, the results of this study substantiate the theoretical proposition that citizenship education serves as a mediating mechanism between technological infrastructure and participatory governance in smart cities. The integration of educational design with digital technology creates a synergistic framework for sustainable urban development. This conclusion supports the arguments advanced by (2) and (18), who demonstrated that participatory governance in smart cities is achievable only through the cultivation of informed, digitally literate citizens. The present study thus contributes to the growing body of knowledge advocating for education as a central pillar of smart city governance and civic innovation.

Despite its methodological rigor, this study faces several limitations that must be acknowledged. The research was conducted within the context of selected Iranian municipalities, which may limit the generalizability of the findings to other regions with different governance structures, cultural contexts, and technological infrastructures. Additionally, while the mixed-method design provided a comprehensive perspective, qualitative insights were based on a limited number of expert interviews, potentially constraining the diversity of viewpoints. The quantitative phase, although statistically robust, relied on self-reported data from municipal employees, which may have been influenced by social desirability or organizational loyalty biases. Furthermore, the cross-sectional nature of the study precludes causal inference; longitudinal research would be needed to confirm how citizenship education initiatives evolve over time and affect civic behaviors in smart cities.

Future research should extend this study by employing longitudinal and cross-national designs to examine how cultural, political, and technological variations influence the implementation and outcomes of citizenship education in smart cities. Comparative studies across different urban contexts could help identify universal versus context-specific components of the model. Future scholars may also explore the role of artificial intelligence and data analytics in personalizing civic education and promoting participatory governance. Moreover, examining the effects of digital literacy programs on marginalized populations, such as individuals with disabilities or low-income residents, would contribute to the inclusivity agenda of smart urbanism. Integrating behavioral and psychological metrics could further deepen the understanding of how education shapes civic attitudes and engagement patterns in data-driven societies.

For practitioners, the findings underscore the necessity of integrating educational planning into smart city strategies. Municipalities should prioritize the establishment of digital learning platforms, continuous civic education programs, and participatory workshops to foster informed citizenship. Investment in technological infrastructure must be paralleled by capacity-building initiatives that enhance citizens' digital competencies. Educational policymakers should collaborate with technology developers to design accessible and engaging learning environments that promote social responsibility and ethical awareness. Finally, public administrators should institutionalize evaluation mechanisms to ensure that citizenship education programs remain adaptive, equitable, and aligned with the evolving dynamics of urban governance in the digital era.

Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

1. Anthopoulos L, Janssen M, Weerakkody V. A Unified Smart City Model (USCM) for smart city conceptualization and benchmarking. Smart Cities and Smart Spaces: Concepts, Methodologies, Tools, and Applications: IGI Global; 2019. p. 247-64.
2. Bastos D, Caballero A, Pereira A. Smart City Applications to Promote Citizen Participation in City Management and Governance: A Systematic Review. informatics. 2023;9(4). doi: 10.3390/informatics9040089.
3. Kitchin R. The Adoption Gap: Ethics, Citizenship, Institutional Factors, and Standards for Smart Cities. IEEE; 2021. p. 1-2.
4. Arabloo I. The Role of Civic Education in Urban Management and Its Impact on Quality of Life and Urban Development. 2021.
5. Torbati AA. Investigating the Obstacles and Challenges to Achieving the Goals Stemming from the Development Programs of Tehran in Urban Management, Transportation, and Traffic - With Emphasis on Education and Cultural Development. Tehran Municipality; 2010.
6. Mohammadpour Zarandi S, Tabatabai Mazdabadi SM. Optimal Implementation of E-Learning and Its Impact on the Economic Performance of Tehran Municipality Managers. Journal of Urban Economy and Management. 2012;4(1):1-13.
7. Hollandsworth R, Donovan J, Welch M. Digital Citizenship: You Can't Go Home Again. TechTrends. 2017:1-7. doi: 10.1007/s11528-017-0190-4.
8. Kolotouchkina O, Barroso CL, Sánchez JLM. Smart cities, the digital divide, and people with disabilities. Cities. 2022;123:103613. doi: 10.1016/j.cities.2022.103613.
9. Huda M, Sabani N, Shahrill M, Jasmi KA, Basiron B, Mustari MI. Empowering Learning Culture as Student Identity Construction in Higher Education. Student Culture and Identity in Higher Education: IGI Global; 2017. p. 160-79.
10. Fathi Vajargah K, Mohammadi F. Fundamentals of Quality Management in Education and Human Resource Development: Ayizh; 2013.
11. Masiha Pour MH, Akbarian M. Smart City Development: The Necessity of Creating an Electronic City. Permanent Secretariat of the Conference; 2016.
12. Ghorchian NG, Eftekharezadeh F. Presenting a Model for Training Professional Citizens in the Higher Education System of the Third Millennium. Future Research in Management. 2006;8(18):80-67.

13. Fazouni Sharjini R, Piri M, Asadian S. Challenges of the Social Studies Curriculum in Primary Education for Social Citizenship Education Based on the Tyler Model. Theory and Practice in Curriculum Studies. 2016;4(7):80-55. doi: 10.18869/acadpub.cstp.4.7.55.

14. Sincer I, Severiens S, Volman M. Teaching diversity in citizenship education: Context-related teacher understandings and practices. Teaching and Teacher Education. 2019;78:183-92. doi: 10.1016/j.tate.2018.11.015.

15. Peterson A, Bentley B. Education for citizenship in South Australian public schools: a pilot study of senior leader and teacher perceptions. The Curriculum Journal. 2017;28(1):105-22. doi: 10.1080/09585176.2016.1184579.

16. Schneider A, Wickert C, Marti E. Reducing complexity by creating complexity: A systems theory perspective on how organizations respond to their environments. Journal of Management Studies. 2016. doi: 10.1111/joms.12206.

17. Ginsburg L, Berta W, Baumbusch J, Rohit Dass A, Laporte A, Reid RC, et al. Measuring work engagement, psychological empowerment, and organizational citizenship behavior among health care aides. The Gerontologist. 2016;56(2):e1-e11. doi: 10.1093/geront/gnv129.

18. Przeybilovicz E, Cucha M, Tomor Z. Citizen participation in the smart city: findings from an international comparative study. Local Government Studies. 2023;48(1):1-12. doi: 10.1080/03003930.2020.1851204.

19. Sargolzai A, Khodadadi Didani HR. Designing a Strategic Roadmap Model for Smart Citizens with a Data-Driven Approach. Quarterly Journal of Public Management Research. 2024;64:349-74.

20. Tofighi Sardroudi Asl P, Karami F, Ghanbari A. Examining the Role of Smartphones in Shaping Destination Image from the Perspective of Citizens in Tabriz Metropolis. Geography and Planning. 2023;27(83):39-48.