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Algorithmic Citizenship Awareness Formation in AI Shaped Democratic Learning Ecosystems

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ABSTRACT

The development of artificial intelligence (AI) technology has affected the way people obtain information, interact, and participate in the life of digital democracy. Algorithms that regulate the distribution of information across various digital platforms indirectly shape people's perceptions, attitudes, and civic participation. This condition requires civic education to be able to respond to changes in the learning ecosystem that are increasingly influenced by digital technology and algorithmic systems. This study aims to analyze the formation of algorithmic citizenship awareness in the democratic learning ecosystem influenced by artificial intelligence. The research uses a qualitative approach with literature study methods on various scientific sources related to civic education, digital literacy, and the development of AI technology in the digital public space. The results of the study show that digital algorithms have an important role in shaping patterns of political participation, access to information, and democratic awareness of citizens. Therefore, civic education needs to integrate digital literacy, algorithmic literacy, and critical thinking skills so that students are able to understand the impact of technology on the democratic process. Such integration is important to form adaptive, critical, and responsible citizens in the digital democracy ecosystem.

Key Word
Citizenship Education, Artificial Intelligence, Digital Literacy, Algorithmic Literacy, Digital Democracy.

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INTRODUCTION

The development of artificial intelligence (AI) technology in recent years has brought significant changes to the way people obtain information, communicate, and participate in social and political life (Battista & Mangone, 2025). The digital ecosystem powered by algorithms now plays an important role in regulating the distribution of information, determining content priorities, and shaping user interaction patterns in digital public spaces (Sousa, 2025). In the context of modern democracy, these changes not only impact political communication patterns, but also affect how citizens understand and carry out their civic roles (Asimakopoulos et al., 2025).

This phenomenon suggests that citizenship in the digital age is no longer formed solely through conventional social processes such as formal education, public discourse, or direct political experience (Mancini, 2020). On the contrary, citizenship awareness is now also influenced by the algorithmic systems that work behind digital platforms such as social media, search engines, as well as various data-based recommendation systems. Algorithms that regulate the flow of information can reinforce certain preferences, form filter bubbles, and influence the way individuals understand public and political issues (Goswami, 2025; Orhan & İşgüzar, 2025). This condition poses new challenges for the practice of democracy as well as for the process of civic education.

In the context of education, these changes require adaptation in the approach to civic learning. Civic education basically aims to form citizens who have democratic awareness, critical thinking skills, and social responsibility in the life of society and the state (Nuzzaci et al., 2024). However, in the midst of the development of a digital ecosystem influenced by artificial intelligence, the process of forming civic awareness is becoming increasingly complex. Students not only need to understand democratic values and citizenship principles, but also need to have the ability to understand how technology and algorithms affect the production and distribution of information in public spaces (Aragani et al., 2025; Head et al., 2020).

The concept of digital citizenship has evolved in response to these changes. This concept emphasizes the importance of digital literacy, ethics of using technology, and the ability to participate responsibly in the digital environment. However, the development of AI technology shows that digital literacy alone is no longer enough. Individuals also need to understand how algorithms work in shaping their digital experiences, including how they can influence political preferences, social perceptions, and participation in democratic processes (Jung et al., 2024; Nuralina et al., 2024).

In this context, an increasingly relevant concept emerges, namely algorithmic citizenship awareness, namely citizens' awareness of the role of algorithms in shaping information experiences, social interactions, and democratic dynamics in the digital space. This awareness is important because without an understanding of algorithmic mechanisms, individuals can potentially become passive users who are unaware of how digital systems affect the way they understand social and political reality.

Although studies on digital citizenship and technology literacy have developed in various educational studies, studies that specifically examine the formation of civic awareness in democratic learning ecosystems influenced by artificial intelligence are still relatively limited. Most of the research still focuses on aspects of digital literacy in general or on the impact of technology on political behavior, while studies that integrate the perspective of civic education with algorithmic dynamics in the learning ecosystem are still not widely developed.

Based on this background, this study aims to analyze the formation of algorithmic citizenship awareness in the democratic learning ecosystem influenced by artificial intelligence. This research is expected to make a conceptual contribution to the development of civic education that is more adaptive to the development of digital technology, as well as strengthen efforts to form critical, reflective, and responsible citizens in facing the dynamics of democracy in the era of artificial intelligence.

RESEARCH METHOD

This study uses a qualitative approach with the literature study method (library research) to analyze the formation of algorithmic citizenship awareness in the democratic learning ecosystem influenced by artificial intelligence technology (Usman et al., 2025). The qualitative approach was chosen because this study aims to conceptually understand the relationship between the development of algorithmic technology, digital literacy, and the process of forming civic awareness in the context of civic education.

The data sources in this study were obtained from various scientific literature relevant to the research topic, including scientific journal articles, academic books, research reports, and scientific publications that discuss civic education, digital democracy, algorithmic literacy, and the development of artificial intelligence technology in the digital public space (Booth et al., 2021). The literature used was selectively selected by considering the relevance of the topic, the credibility of the source, and its contribution to the development of the conceptual framework of the research.

The data collection technique is carried out through the process of tracing and reviewing scientific documents related to the research theme. This process includes the identification of relevant literature, the classification of key concepts related to digital citizenship and algorithms in the information ecosystem, and the organization of scientific findings that support research analysis (Taherdoost, 2021).

Data analysis was carried out using descriptive-qualitative analysis techniques with a thematic analysis approach. In this process, the researcher identifies the main themes that emerge from various sources of the literature, then examines the relationship between concepts related to the role of algorithms in shaping civic awareness. The analysis stages include the process of data reduction, conceptual categorization, interpretation of findings, and the preparation of a conceptual framework regarding the formation of algorithmic citizenship awareness in the democratic learning ecosystem based on artificial intelligence technology.

To maintain the validity of the study, this study uses a source triangulation technique by comparing various different scientific literature to ensure the consistency of the concepts and arguments used. Through this methodological approach, the

research is expected to be able to produce a comprehensive analysis of how the development of algorithmic technology affects the process of forming civic awareness in civic education in the digital era.

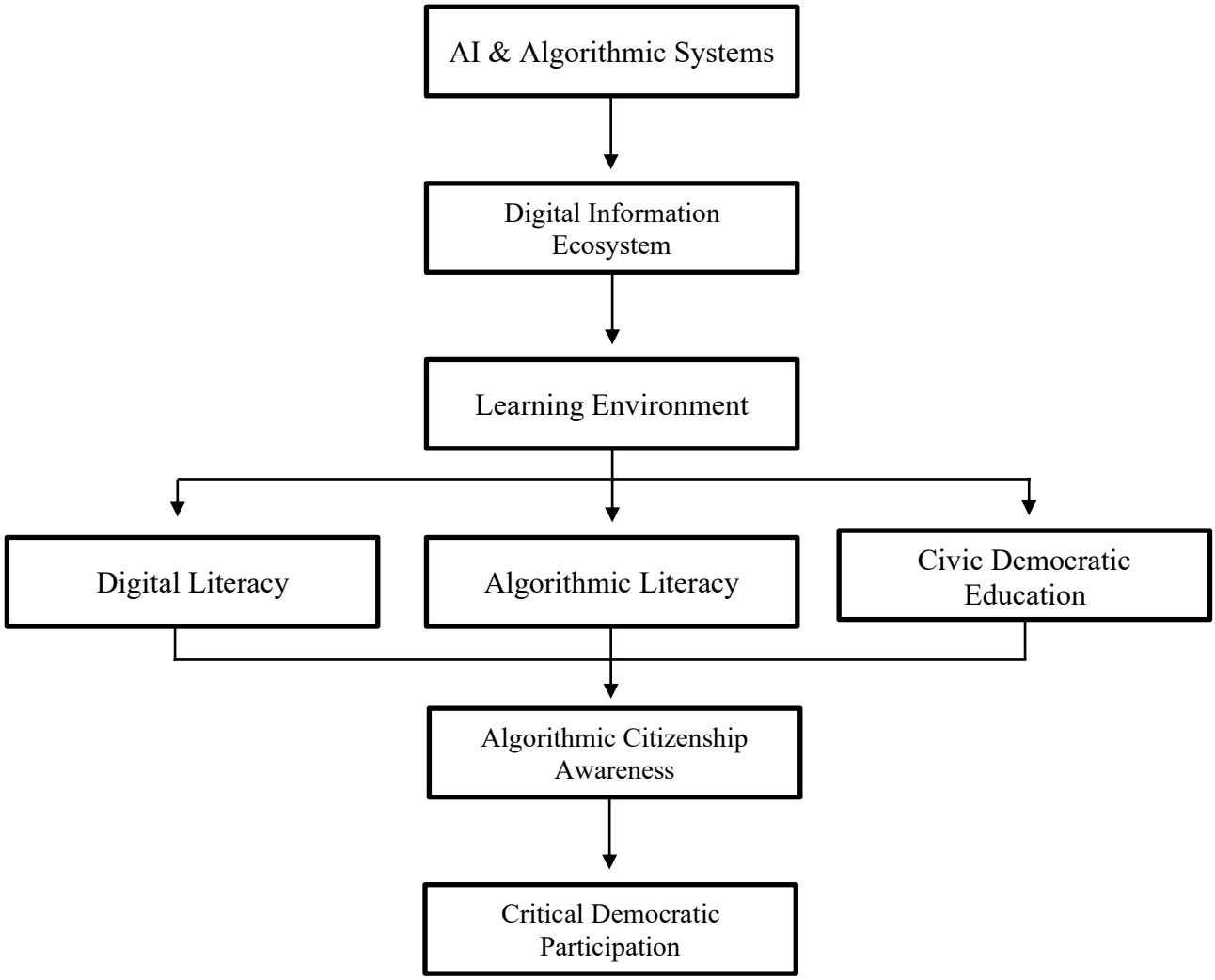

Figure 1.
Algorithmic Citizenship Awareness Framework

RESULTS AND DISCUSSION

The results of the literature review show that the development of artificial intelligence (Artificial Intelligence) and algorithmic systems has formed new dynamics in the democratic learning ecosystem. Digital algorithms play a role in regulating the distribution of information, influencing user preferences, and shaping patterns of public participation in the digital space. In the context of civic education, this phenomenon suggests that the formation of civic consciousness is no longer only influenced by

conventional social interactions, but also by algorithmic systems that regulate the flow of digital information.

Based on a thematic analysis of various relevant literature, this study identifies several key themes that explain the relationship between algorithmic technology and the formation of civic consciousness in the AI-based democratic learning ecosystem.

Table 1.
Thematic Findings on Algorithmic Citizenship Awareness Formation

Theme	Description	Educational Involvement
Algorithmic influence on information flow	Digital algorithms determine the content of information that appears in digital platforms	Need algorithmic literacy in civics education
Digital media ecosystem	Social media and digital platforms are the main spaces of public discourse	Civics education needs to integrate digital literacy
Democratic participation in digital space	Citizen interaction is increasingly happening in the digital space	Requires critical digital participation capabilities
Algorithmic citizenship awareness	Individual awareness of the influence of algorithms on public information	Becoming a new competency in civic education

Algorithmic Systems and Information Exposure

The results of the study show that digital algorithms play an important role in determining the exposure to information received by individuals. The recommendation system used by social media and search engines works by leveraging user behavior data to present the content that is considered most relevant. However, this mechanism often results in the phenomenon of filter bubbles and echo chambers, where individuals are more often exposed to information that is in line with their preferences.

In the context of democracy, this condition has the potential to affect the way individuals understand public issues and shape their political preferences. Therefore, awareness of algorithmic mechanisms is an important factor in building citizens' ability to critically evaluate information.

Table 2.
Summary of Previous Studies on Algorithms and Digital Citizenship

Author	Focus of Study	Key Findings	Relevance to This Study
Gritsenko & Wood (2022)	Algorithmic governance	Algorithms influence public information exposure	Explain the influence of algorithms in digital public spaces
Lehdonvirta (2022)	Digital platform governance	Platform algorithms shape political communication	Supports the concept of algorithmic citizenship
Mihailidis & Viotty (2021)	Civic media literacy	Digital literacy improves democratic participation	Basis for strengthening digital citizenship literacy
Gillespie (2022)	Algorithmic systems	Algorithms curate information flow in online platforms	Demonstrating the importance of algorithmic awareness

Digital Literacy and Algorithmic Awareness

Literature review shows that digital literacy is the main foundation in dealing with a technology-based information ecosystem. Digital literacy is not only related to the ability to use technology, but also includes the ability to understand the credibility of information, evaluate news sources, and understand how information is produced and disseminated in the digital space.

However, the development of AI-based technology shows that digital literacy alone is not enough. Individuals also need algorithmic literacy, which is the ability to understand how algorithmic systems work in determining the distribution of information.

Table 3.
Key Components of Algorithmic Citizenship Awareness in Civic Education

Component	Description	Role in Civic Education
Digital Literacy	Ability to understand and evaluate digital information	Helping citizens understand public information
Algorithmic literacy	Understanding of how digital algorithms work	Increase awareness of information

		recommendation systems
Critical thinking	Ability to analyze information reflectively	Reducing the influence of disinformation
Democratic values	Understanding the value of democracy and public participation	Encourage responsible civic participation

Integration of Civic Education and AI-Based Learning Ecosystems

The findings of the study also show that citizenship education has an important role in helping students understand the dynamics of democracy in the era of digital technology. The integration of digital literacy, algorithmic literacy, and democracy education can help form a citizenship awareness that is more adaptive to technological developments.

In this context, civic learning focuses not only on the normative understanding of democratic values, but also on the ability to understand how technology affects the structure of public communication and decision-making processes in society. Based on the results of the literature analysis, this study shows that the formation of algorithmic citizenship awareness is influenced by the interaction between algorithmic technology, the digital information ecosystem, and the citizenship education process. The integration between digital literacy, algorithmic literacy, and democratic values is an important factor in shaping citizens who are able to participate critically in the digital society.

Thus, civic education in the era of artificial intelligence needs to develop a learning approach that not only emphasizes normative understanding of democracy, but also the ability to understand how digital technology shapes the dynamics of public space and political participation.

Discussion

The results of this study show that the development of algorithmic systems in the digital ecosystem has significant implications for the formation of civic awareness in modern society. The algorithms that govern the distribution of information on digital platforms not only serve as a technical mechanism, but also act as a mediator that influences how individuals acquire, understand, and interpret public information (Shin et al., 2022). In this context, algorithmic systems can be seen as part of the digital communication infrastructure that indirectly shape the patterns of public discourse and democratic participation (Williams, 2025).

The findings of this study are in line with the view that digital algorithms have become important actors in the structure of contemporary public communication. Gillespie (2018) states that algorithms on digital platforms function as an information curation mechanism that determines the visibility of content in digital public spaces.

Thus, algorithms not only present information, but also influence how it is prioritized and distributed to users. This condition makes algorithms an important element in understanding the dynamics of democracy in the digital era.

In the perspective of civic education, the findings of this study show that the formation of civic awareness can no longer be separated from the dynamics of digital technology. Civic education has traditionally focused on instilling democratic values, citizens' rights and obligations, and participation in public life. However, in an algorithm-based information ecosystem, civic competencies also need to include the ability to understand how digital technologies affect the distribution of information and the formation of public opinion.

These findings support the concept of digital citizenship which emphasizes the importance of digital literacy as part of modern citizenship competencies. Digital literacy allows individuals to critically evaluate information as well as understand how information is produced and disseminated in a digital environment (Mihailidis & Viotty, 2017). However, the development of artificial intelligence technology shows that digital literacy alone is not enough to deal with the complexity of the digital information ecosystem.

This research shows that algorithmic literacy is an important component in building civic awareness in the era of artificial intelligence. Algorithmic literacy refers to the ability of individuals to understand the basic mechanisms of algorithmic systems that govern the flow of digital information. By understanding how algorithms work, individuals can be more aware of possible biases in the distribution of information as well as be better able to evaluate the content they receive in the digital space.

In addition, the research findings also show that the integration between digital literacy, algorithmic literacy, and civic education has the potential to strengthen democratic awareness in a digital society. This approach allows students not only to understand democratic values normatively, but also to understand how digital technology can affect the democratic process itself. In this context, civic education acts as a learning space that helps individuals develop reflective abilities in dealing with the dynamics of technology and democracy.

The findings of this study also show that the formation of algorithmic citizenship awareness can contribute to strengthening democratic participation that is more critical and responsible. Individuals who are aware of the influence of algorithms tend to be better able to critically evaluate information, avoid disinformation, and participate more reflectively in digital public discourse. This shows that strengthening algorithmic literacy in civic education can be an important strategy in building democratic resilience in the digital era.

Overall, the results of this study show that the development of artificial intelligence technology has not only brought about changes in the way information is

disseminated, but also in the way citizenship awareness is formed. Therefore, civic education in the digital era needs to develop a learning approach that is able to integrate digital literacy, algorithmic literacy, and democratic values. This approach is expected to help shape citizens who are not only technologically literate, but also have a critical awareness of the influence of technology in democratic life.

CONCLUSION

This research shows that the development of artificial intelligence technology and algorithmic systems has changed the way information is produced, distributed, and consumed in digital public spaces. Digital algorithms not only function as a technical mechanism in digital platforms, but also play a role in shaping information exposure, public opinion, and patterns of democratic participation of the community. In this context, the formation of algorithmic citizenship awareness is an important aspect of citizenship education in the era of artificial intelligence.

The results of the study confirm that the integration between digital literacy, algorithmic literacy, and civic education is a relevant approach to build critical and reflective civic awareness in dealing with digital information dynamics. Understanding how algorithms work allows citizens to evaluate information more critically and participate more responsibly in digital public discourse.

Based on these findings, civic education needs to develop a learning model that integrates the understanding of digital technology with the strengthening of democratic values. Strengthening algorithmic literacy in the citizenship curriculum is expected to help form citizens who are adaptive to technological developments while being able to participate critically in democratic life in the digital era.

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