

Dynamics of Implementing Digital Technology Development in Sociology Learning

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Abstract

The development of technology in the era of the Fourth Industrial Revolution has brought significant changes in various aspects of human life, one of which is in the field of education. The integration of education is key in transforming the paradigm of education. With rapid changes, it demands a more innovative education system, not only in the use of technology but also in ensuring sustainability and access to education for everyone. However, challenges such as the digital divide, infrastructure readiness, and the lack of digital literacy among teachers and students remain major obstacles. This research aims to understand the role of training in enhancing the digital competence of Sociology teachers. The main theory used is Paulo Freire's liberating education. This research method uses descriptive qualitative with a case study method. Data were collected through observation, documentation, and questionnaires from the training participants. Then the data was analyzed using the Miles and Huberman model. The research results show that: (1) the training is able to enhance teachers' understanding of digital technology, (2) there is a transformation of learning into a student-oriented approach through problem-based learning, (3) teachers are starting to integrate artificial intelligence to prepare teaching materials and assessments.

Keywords : digital competence, teacher Sociology, educational technology, learning strategies, sustainable education.

Background

The transformation of education in the era of the Fourth Industrial Revolution is becoming increasingly evident, along with the rising use of digital technology in the learning process. In Indonesia, internet penetration continues to increase, becoming a key indicator of infrastructure readiness to support technology-based education. Based on data from the Indonesian Internet Service Providers Association (APJII), Indonesia's internet penetration rate in 2024 reached 79.5%, up from 78.19% the previous year [1]. Meanwhile, a UNESCO report indicates that access to digital technology is a crucial factor in achieving the Sustainable Development Goals (SDGs), particularly in realizing quality and inclusive education [2]. However, despite the increase in internet access, the digital divide remains a challenge. According to an APJII survey, underdeveloped regions in Indonesia still face connectivity challenges [1]. This condition directly impacts students' learning opportunities, especially for those living in areas with minimal technological infrastructure. Therefore, many phenomena such as the digital divide, infrastructure readiness, and the lack of digital literacy among teachers and students still pose major obstacles to achieving sustainable education [3]. The readiness of teachers to utilize technology becomes a determining factor in the effectiveness of educational transformation. A study by UNESCO emphasizes that teachers' digital literacy significantly influences the creation of adaptive and innovative learning environments [4]. One important factor in this transformation is the role of teachers, who are not only educators but also facilitators and innovators in learning [5]. Teachers not only need to understand technology but also must be able to use it effectively in teaching to encourage creativity, critical thinking, and collaboration among students [6]. Therefore, continuous training, adequate policy support, and an inclusive learning environment are crucial factors in building an education system that is responsive to the changing times. This study emphasizes that the success of educational transformation cannot be separated from the roles of various stakeholders, including the government, educational institutions,

industry, and society [7]. Investment in digital infrastructure, more flexible curriculum reforms, and evidence-based policies that ensure the inclusivity and quality of education are maintained are needed. With a more humane and needs-based approach, the education system can better adapt to the challenges of the 4.0 era without sidelining humanitarian values.

In the ever-changing world of education, digitalization presents both challenges and opportunities that can be studied through the lens of sociology. Therefore, digital sociology is a breakthrough by contemporary thinkers in their efforts to understand various complex issues arising from human-computer interaction (HCI) or technology in modern society, and such interactions are now developing very rapidly. This also impacts the world of education, especially in the classroom learning system. The paradigm of education is shifting from teacher-oriented to student-oriented. Education in the digital era should be able to create inclusive, adaptive, and empowering learning spaces for students. So that teachers have adequate digital competence and students have equal access and ability to technology. However, the facts on the ground show, based on the researchers' initial observations, that sociology teachers in the MGMP of Surakarta City have not received adequate training to integrate technology into the learning process. In the context of educator competence, data from the Indonesian Ministry of Education, Culture, Research, and Technology shows that many teachers still lack adequate digital skills [8]. Reports from the Program for International Student Assessment (PISA) also reveal that many Indonesian students lag behind in critical thinking and problem-solving skills compared to other countries [9].

This underscores the urgency of enhancing teachers' capacities so that they are not only able to use technology but can also effectively integrate it into 21st-century competency-based teaching methods. Adapted 4 competencies that teachers must possess, which include: pedagogical competence, personality competence, social competence, and professional competence. These four competencies are holistic and integrative in the performance of teachers. Moreover, although the digitalization of education can expand access to learning, its implementation must still consider the aspect of humanizing education. UNESCO emphasizes that education is not only about the transfer of knowledge, but also about shaping character, ethics, and empathy [10]. Therefore, the transformation of education in the digital era does not only focus on the adoption of technology, but also on the application of technology to enhance more meaningful interactions between teachers and students. By examining the role of teachers, infrastructure readiness, and challenges in reducing the digital divide, this research is expected to provide evidence-based policy recommendations to sustainably improve the quality of education in Indonesia.

Research Method

The systematic literature review (SLR) method is used in this research to investigate the dynamics of digital technology development and its application in sociology learning to achieve sustainable education. This method was chosen due to its ability to systematically, clearly, and replicably discover, evaluate, and synthesize empirical evidence. Three elements in the main focus of this research include: (1) the role of digital technology in the democratization of sociology education; (2) the shift in the learning approach from teacher-centered to student-centered; and (3) digital sociology as a tool for sustainable education. To complement the literature search, leading academic databases such as Scopus, Web of Science, ERIC, ScienceDirect, IEEE Xplore, and Google Scholar were used. The articles being searched for are scientific journals in English and Indonesian from the years 2020 to 2025. The purpose of the journal search is to understand the latest developments related to the integration of digital technology in sociology education. The initial search yielded 734 articles from the entire database. After the screening process based on titles and abstracts, 152 articles that are appropriate and relevant to this research topic were obtained. Next, a full-text evaluation was conducted using the predetermined inclusion and exclusion criteria, resulting in the selection of 15 relevant articles that met the expected methodological quality for further analysis. The article selection process used the inclusion criteria: (1) peer-reviewed articles, (2) focusing on the use of digital technology in the context of sociology learning, (3) containing a relationship with aspects of sustainable education or liberation, (4) fully accessible. Articles that are opinion pieces, editorials, book reviews, or theses are not included. Data from each article are extracted using a format that includes bibliographic data (author, year, title, journal, DOI), research methodology, learning context, type of digital technology used, objectives and main findings, as well as contributions to sustainable education. The analysis was conducted descriptively and thematically. The thematic analysis follows the stages outlined by Braun & Clarke (2006): data familiarization, initial coding, theme searching, theme reviewing, theme naming, and report writing. The findings are synthesized narratively based on three main focuses: the dynamics of digital technology in education, the transformation of pedagogical approaches, and its contribution to sustainable and liberating sociology education.

Result and Discussion

1. The Role of Digital Technology in the Democratization of Sociology Education Sociology Education

Education for Sustainable Development (ESD) is an educational approach aimed at equipping learners with knowledge, skills, and attitudes oriented towards sustainability (11). ESD emphasizes the importance of integrating environmental, social, and economic values into the learning process. Through the implementation of ESD, education does not only focus on academic achievements, but also on a deep understanding of sustainable development issues in local, national, and global contexts. Teachers are required to have adequate skills and knowledge to design and implement educational programs that prioritize sustainability. The criteria for implementing ESD in education encompass several important aspects, including: encouraging active participation and responsibility among learners in the learning process; developing holistic and interdisciplinary education; using diverse methods to activate learning; and adopting a systemic approach by involving the community in finding solutions to environmental issues (12). In addition, learning must also be able to develop norms and values that can be critically examined, integrate local wisdom as well as global culture, and foster an inclusive learning spirit for everyone. In the context of the Merdeka Curriculum, the Project Based Learning (PBL) approach has become one of the strategic means to concretely realize ESD (Education for Sustainable Development). One of the concrete implementations can be seen in the Pancasila Student Profile Strengthening Project (P5) at the high school level. Through this project, students are actively involved in research activities, identifying social and environmental issues, and designing sustainable solutions. PBL also fosters teamwork skills, communication with stakeholders, as well as critical thinking and problem-solving skills (14).

Along with the digital transformation in the world of education, the need for interactive, independent, and socially connected online learning is also increasing. In this regard, the Community of Inquiry theory offers an important conceptual framework. This theory emphasizes that effective online learning is not merely about transferring materials to a digital platform, but must embody a collaborative and democratic pedagogical approach. Digital technology, in this view, becomes a tool to expand access to education and strengthen the active and inclusive participation of learners. Manuel Castells also emphasizes the role of the internet in giving rise to new forms of social movements and the democratization of knowledge. The virtual world becomes a space of autonomy for marginalized groups to voice their aspirations. In the context of education, Castells emphasizes the importance of digital literacy and critical engagement as the foundation for democratic education in the networked era. Education no longer takes place solely in physical spaces, but also in virtual spaces that facilitate ideological interactions and public participation. On the other hand, the theory of connectivism asserts that learning in the digital era is not centered on the individual, but rather on interconnected information networks. Knowledge is now fluid, widely dispersed, and constantly changing. Therefore, the ability of learners to establish and manage connections becomes a key competency in the learning process. This theory reshapes the perspective on the roles of teachers and students, where both collaborate in a learning environment that is adaptive, open, and integrated with technology.

This transformation also demands universities to innovate in their educational structures and approaches. The hierarchical and closed model of higher education is considered no longer relevant. Instead, higher education institutions need to adopt a collaborative, participatory, and democratic network model. Digital technology enables the realization of universities that are more transparent and aligned with the dynamics of the 21st century. This transformation is not merely technical, but paradigmatic and involves a way of thinking about authority, knowledge, and educational practices that are socially meaningful. However, it should be noted that digital transformation also presents serious challenges in the form of the digital divide or technology access gap. This disparity creates a new form of social injustice in the world of education. Students who do not have access to basic digital infrastructure will lose the opportunity to learn, participate, and develop. Therefore, technology-based education policies must be designed inclusively and with an awareness of the socio-economic context, so as not to deepen existing inequalities. The success of digital education is greatly determined by the system's ability to ensure equitable access and equal learning opportunities for all.

2. Liberation Education as a Transformation from Teacher-Oriented to Student-Oriented

Education is not merely a formal activity in the classroom, but rather a comprehensive life process and an ongoing learning experience throughout one's life (lifelong learning). In this process, the comfort and active involvement of learners become the main keys. UNESCO formulated four pillars of education that describe the dimensions of learning as a whole, namely: learning to know, learning to do, learning to be, and learning to live together. These pillars affirm that learning is not merely the activity of the teacher instructing, but rather a personal experience that grows from individual awareness and involvement. This idea aligns with the thoughts of Paulo

Freire, a figure in liberation education, who emphasized that the goal of education is to free humans from the shackles of unconsciousness. For Freire, ideal education is education that can foster critical consciousness (the highest human awareness in understanding and responding to the surrounding social reality). This process begins with the selection of generative themes, which are issues rooted in the concrete realities of society. These themes are then codified and visualized simply in an easily understandable language, allowing the community to delve deeper into self-understanding of the situations they face.

Education, according to Freire, must respect humans as the center of the learning process. Freire not only talks about the content of the curriculum but also how the curriculum is structured to equip students to become cultured, productive individuals who contribute to society. Especially in the digital era marked by competition and rapid changes, education is required to create learning experiences that are not only enjoyable but also meaningful. In this context, the transformation of learning from a teacher-oriented approach to a student-oriented one becomes highly relevant. This approach does not mean eliminating the role of the teacher, but rather emphasizes the importance of balancing control between the teacher and student independence. Blended learning emerges as a strategy that bridges this shift. Through a combination of online and face-to-face learning, blended learning expands the learning space while providing flexibility for students to manage their own learning process. This approach also allows for adjustments to different learning styles, as well as encouraging autonomy and active cognitive exploration.

On the other hand, there is the concept of learning 2.0 enriching the dimensions of learning in the digital era. The internet is no longer just a source of information, but rather a dynamic arena for social interaction. Students are not only recipients of information but also active producers of knowledge through discussion forums, collaborative projects, and open learning communities. In this space, a more inclusive participatory pedagogy for all individuals is born. This learning model is reinforced by the Community of Inquiry Framework, which emphasizes the importance of social, cognitive, and teaching presence in the online learning process. Meaningful interactions between students, whether in person or virtual, become an important element in building reflection and critical awareness. Therefore, blended learning is not just a method, but a transformative strategy that shapes a new way of viewing education as a space for dialogue, not just a teacher's monologue. This change is also driven by the awareness of the presence of a new generation: digital natives. They were born and grew up in a digital environment, having different learning preferences that are fast, interactive, and visual. The conventional approach that is passive and teacher-centered can no longer meet their needs. Education must transform, aligning itself with the mindset and learning characteristics of this generation to remain relevant and impactful. This is where Vygotsky's sociocultural theory finds its relevance once again. Through the concept of the Zone of Proximal Development (ZPD), Vygotsky explained that learning occurs in a social context, through interaction and assistance known as scaffolding. Technology can be a tool that extends the reach of this scaffolding: from online discussions, collaborative projects, to more structured personal guidance. The learning process becomes increasingly personal, dynamic, and tailored to the needs of each individual.

In the end, the transformation of education from teacher-oriented to student-oriented is not just a pedagogical discourse. It is a necessity in facing the realities of the times. The liberating education championed by Freire, the collaborative digital approach offered by learning 2.0, and the theoretical foundations of the Community of Inquiry and ZPD weave a common thread: education must be humane. It must empower, open spaces for dialogue, appreciate diversity, and foster a spirit of learning that grows from within the learners themselves. Because in essence, education is not about how much we teach, but how far we can liberate the human potential within each individual.

3. Implementation of Digital Sociology to Realize Sustainable Education

Modernization has brought many changes to human life. Because of modernization, various problems have developed in an advanced manner and manifested into unique issues. Some problems frequently encountered in the digital era include issues of cybercrime, hyper-reality interaction, green public sphere, and global warming. All of that, of course, was never imagined before by classical or modern thinkers. Therefore, digital sociology seeks to address various issues of human interaction with technology. In this context, Lupton (2015) introduced the concept of digital sociology as an approach to understanding social life that is continuously connected with digital media, big data, and online platforms. Digital sociology not only serves as an analytical tool but also as a reflective medium in education, particularly in sociology learning. The use of digital media in education allows for the creation of dialogic and interactive spaces between teachers and students, strengthening participation, and enhancing critical awareness of contemporary social issues that are dynamic and global in

nature. Although digital sociology has a broad scope, Deborah Lupton has her own limitations regarding what she describes as the definitive lines of the concept of digital sociology [17], namely:

(1) **Digital Professionalism Practice**: In this case, the use of media or technology that is digital is intended for professional activities, such as providing virtual teaching, establishing academic relationships, and so on; (2). **Analyses of Digital Technology**: Providing a comprehensive understanding of the use of digital media by individuals to manage their self-concept and social relationships in their lives; (3) **Digital Data Analysis**: Regarding the utilization of various digital data for the purposes of social research, whether it be quantitative or qualitative research; (4) **Critical Digital Sociology**: Regarding the things obtained from digital media, they can be addressed wisely by taking analytical, critical, and reflective actions, in accordance with the existing theories of social sciences and humanities.

The four important aspects of digital sociology proposed by Deborah are actually just boundaries to prevent its scope from expanding further. The establishment of such concrete boundaries is indeed necessary so that the study being conducted does not become increasingly global. When that happens, the focal point will be lost and the problem that is supposed to be solved will become even more unclear [17]. On the other hand, Savage and Burrows (2007) warn of a crisis in empirical sociology due to its lag in responding to the development of digital data. They emphasize the importance of methodological updates in sociology to understand social realities based on big data and algorithms. Therefore, sociology education needs to integrate data literacy and digital analysis skills so that students can evaluate social phenomena scientifically and evidence-based. This is a strategic step in shaping a generation that is not only sensitive to social issues but also capable of providing data-based solutions in the context of sustainable development. Popular culture disseminated through new media is influenced by the circulation of political logic and digital algorithms (Beer 2013). In the context of sociology education, the use of popular culture content such as videos, memes, or social media trends can serve as entry points to discuss social issues in a contextual manner that is relevant to students' lives. This enriches the participatory and reflective nature of sociology learning methods. However, teachers also need to teach how digital content is constructed and distributed so that students can understand the power behind technology, as well as develop critical digital literacy as part of sustainable education.

Finally, UNESCO (2020) in Education for Sustainable Development: A Roadmap emphasizes the importance of transformative education, which not only transfers knowledge but also shapes values, attitudes, and actions towards a sustainable future. The implementation of digital sociology in education enables the achievement of these goals through the development of competencies such as critical thinking, systemic thinking, as well as collaboration and reflection skills. By combining sociology, digital technology, and the spirit of sustainability, sociology education in the digital era can become a strategic vehicle for fostering student awareness and social action in building an inclusive, just, and sustainable society. Paulo Freire (1970) in Pedagogy of the Oppressed emphasizes the importance of liberating education through dialogical and reflective approaches. In the digital era, Freirean approaches can be modified through technology that supports collaboration, such as online discussion platforms and social media that allow students to express opinions and form critical social understanding. The application of critical pedagogy principles in the digital space can empower students to become active subjects in the sociology learning process, encourage their engagement in sustainable issues, and foster collective awareness of social inequalities and environmental crises

Conclusion and Suggestion

The transformation of education in the era of the Fourth Industrial Revolution demands significant changes in the roles and competencies of teachers, particularly in effectively integrating digital technology into the learning process. Sociology teachers are not only required to master pedagogical, personal, social, and professional competencies holistically, but they must also possess strong digital literacy to meet challenges and seize opportunities in the digital era. Through a learner-centered approach, such as Project Based Learning and the integration of Education for Sustainable Development (ESD) values, teachers can create a more democratic, participatory, and inclusive educational ecosystem. Findings from a systematic literature review indicate that digital technology plays a crucial role in democratizing access to education, expanding student participation, and supporting the achievement of sustainable education goals. However, significant challenges remain, particularly related to the digital divide, limited infrastructure, and low digital skills among teachers. Therefore, sustainable policy interventions, needs-based training, and cross-sector collaboration between the government, schools, communities, and industry are needed to support the strengthening of teachers' capacities in the digital era. The application of technology in education should not be purely technocratic; rather, it must be accompanied by a humanistic approach that positions teachers and students as active subjects in the learning process. Through the

perspective of digital sociology, educational transformation can be viewed as a complex and dynamic social process, where teachers play a central role as agents of change in creating adaptive, critical, and socially just learning environments. Thus, strengthening the digital competencies of Sociology teachers becomes a strategic key in building a resilient, inclusive, and sustainable education system in Indonesia.

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