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## Implementation of 21st Century Skills in Informatics Subjects by Applying Google Sites for 9th Grade Students at SMPN 6 Darangdan

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### ABSTRACT

21st-century education demands the integration of technology to develop 6C skills contextually. This study aims to describe the implementation of Google Sites in supporting 6C skills in ninth-grade Informatics learning at SMP Negeri 6 Darangdan. The study used a qualitative approach with a single case study design. Data were obtained through observation, in-depth interviews with the principal, teachers, and five students, as well as documentation, then analyzed using the interactive model of Miles, Huberman, and Saldaña. The results showed that project-based learning through Google Sites was able to develop critical thinking and creativity through digital content design, and strengthen collaboration and communication through teamwork and presentations. The dimensions of character and citizenship were internalized through ethical digital publication practices. However, structural obstacles were found in the form of limited infrastructure and technical readiness. It was concluded that the effectiveness of strengthening 6C is more determined by reflective pedagogical design than the complexity of the technology used.

## 1. Introduction

The development of science and technology in the 21st century has significantly transformed various aspects of human life, including the education sector. Educational systems are no longer oriented solely toward mastering conceptual knowledge but also toward developing competencies that enable learners to adapt to rapid social, technological, and economic changes. In this context, 21st-century education emphasizes the development of higher-order thinking skills, creativity, collaboration, communication, and strong character as essential competencies for

students to face global challenges (Astuti, 2024; Rahmawati & Salehudin, 2021). The integration of digital technology in education has also accelerated the transformation of learning practices by providing wider access to information, interactive learning resources, and new opportunities for collaborative learning. Studies have shown that digital learning environments can support students in developing problem-solving skills, digital literacy, and adaptive learning behaviors that are essential in modern society (Sukma & Hikmawan, 2026; Pratama et al., 2026). Therefore, the integration of technology into teaching and learning processes has become an important strategy for preparing students to participate actively in the knowledge-based society of the 21st century.

One framework that is widely adopted to support these competencies is the 6C skills framework, which includes critical thinking, creativity, collaboration, communication, character, and citizenship. These competencies are considered essential foundations for preparing students to become innovative, responsible, and socially aware individuals who are capable of contributing to digital society (Astuti, 2024; Akmal et al., 2023). In Indonesia, national education policies such as the 2013 Curriculum and the Merdeka Curriculum emphasize learner-centered learning, contextual learning experiences, and the integration of information and communication technology (ICT) to support the development of these competencies (Nabilah et al., 2023; Ministry of Education and Culture, 2018).

The effective use of ICT in learning enables teachers to design more engaging, interactive, and authentic learning experiences that connect classroom learning with real-world contexts. Previous studies have demonstrated that technology-based learning media can increase student engagement, expand learning resources, and facilitate meaningful learning experiences (Habib et al., 2020; Hanannika & Sukartono, 2022; Wardani et al., 2024). In addition, the integration of digital platforms in education has also been shown to improve students' learning outcomes, digital competencies, and engagement when implemented with appropriate pedagogical strategies (Lana et al., 2026; Kumalasari et al., 2026).

Despite the growing importance of ICT integration in education, its implementation at the junior high school level still faces various challenges. Teachers often encounter difficulties in selecting digital learning media that are not only accessible and easy to use but also capable of supporting the development of 21st-century competencies. Many digital learning platforms are designed primarily to deliver learning materials rather than to facilitate collaborative, reflective, and student-centered learning processes. This condition often results in technology being used merely as a tool for content delivery rather than as a means to transform learning practices (Habib et al., 2020; Hanannika & Sukartono, 2022). In addition, the success of digital learning implementation is also influenced by institutional leadership, teacher readiness, and the overall digital culture within schools (Azizah et al., 2026). Therefore, the selection of digital learning media should consider not only technological aspects but also pedagogical strategies that support active learning and the development of 21st-century competencies.

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One digital platform that has the potential to support such learning is Google Sites, a web-based platform that allows teachers to create structured learning environments without requiring advanced programming skills. Through Google Sites, teachers can integrate learning materials, multimedia resources, collaborative activities, and digital assignments in a single online learning space. Previous studies have shown that the use of Google Sites can increase student motivation, improve learning outcomes, and support flexible learning environments, including blended and distance learning contexts (Japrizal & Irfan, 2021; Hartari & Putra, 2025). However, most existing studies on Google Sites focus primarily on measuring learning outcomes or evaluating the effectiveness of the media using quantitative approaches or research and development methods (Japrizal & Irfan, 2021; Pangesti et al., 2025; Faizah et al., 2025). As a result, there is still limited understanding of how Google Sites is implemented in actual classroom practices to support the development of 21st-century skills, particularly in Informatics education at the junior high school level.

Several recent studies have emphasized the importance of integrating digital platforms and web-based learning environments to foster 21st-century competencies such as critical thinking, creativity, digital literacy, and collaboration among students (Setianingsih et al., 2024; Dini et al., 2024; Nandini et al., 2026). Furthermore, research has also highlighted that technology-supported learning environments can help bridge educational gaps and support more inclusive learning opportunities when combined with appropriate pedagogical approaches (Isfa'Lana et al., 2026). In the context of Informatics education, the use of interactive and digitally mediated learning strategies is particularly important because the subject itself is closely related to technological literacy, computational thinking, and problem-solving skills (Nabilah et al., 2023; Wiranda & Ciptaningrum, 2024). A contextual and reflective technology-based learning approach is therefore considered essential to support deeper student engagement and meaningful learning experiences (Sayadi & Pangandaman, 2025; Zou et al., 2025).

The phenomenon of gaps in the implementation of 21st-century skills was also observed at SMP Negeri 6 Darangdan. Preliminary observations indicated that although the school had adequate ICT facilities, their use in Informatics learning was still not fully optimized to support the development of students' 6C competencies. Teachers had begun to explore the use of Google Sites as an innovative learning medium; however, its role in supporting collaboration, critical thinking, character development, and digital learning experiences among students had not been explored in depth. This situation makes SMP Negeri 6 Darangdan an important context for examining how digital learning media can be integrated into classroom practices to support the development of 21st-century competencies. Based on these considerations, this study aims to explore how 21st-century skills are implemented in Informatics learning through the use of Google Sites among ninth-grade students at SMP Negeri 6 Darangdan using a qualitative single-case study approach.

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## 2. Methodology

This study uses a qualitative approach with a single case study design. This approach was chosen due to its relevance in exploring complex educational phenomena where the boundaries between the phenomenon and its context are not clearly visible. Recent literature affirms that exploratory case studies are highly effective in answering "how" and "why" questions in the context of technology integration in schools, and they allow researchers to capture the dynamics of human interactions that cannot be measured solely with numbers (Mohajan, 2018). In addition, this type of research allows for the in-depth exploration of participants' (teachers and students) experiences in their natural environment without experimental manipulation (Tenny et al., 2022).

This study was conducted at SMP Negeri 6 Darangdan. This location was chosen purposively (purposive sampling) based on the criterion of case uniqueness: (1) The school has implemented the Independent Curriculum Phase D; 2) The Informatics teacher actively uses Google Sites as the main learning medium; and (3) There is a gap between the availability of ICT facilities and the optimization of 21st-century skills, which is the focus of this study. The main unit of analysis in this study is the Informatics learning process mediated by Google Sites. The focus of the analysis is directed at how instructional interactions and technology features in Google Sites stimulate the elements of the 6C skills (Critical thinking, Creativity, Collaboration, Communication, Character, Citizenship) in ninth-grade students.

The single case study approach in this research was chosen by considering the characteristics of phenomena that are contextual and tied to learning practices in a particular educational unit. A case study allows the researcher to examine in depth the interactions between school policies, teachers' pedagogical strategies, and students' learning experiences within a complete system. In the context of learning technology integration, this approach is relevant because the implementation of digital media cannot be separated from school culture, infrastructure readiness, and specific classroom dynamics. Thus, the case study design provides space to capture the complexity of the relationship between project-based learning design and the holistic development of 6C skills.

Data in this study were obtained from key informants, namely the Computer Science Teacher and the Principal, as well as supporting informants consisting of five ninth-grade students selected to represent variation of learning experiences. In addition to interview data, this study is also supported by supporting documents in the form of Teaching Modules, digital archives of Google Sites displays used in learning, as well as student work artifacts as evidence of the implementation of project-based learning.

Data collection in this study was carried out through a technique triangulation which included participant observation, in-depth interviews, and documentation studies. Participant observation was conducted during the learning process to capture the dynamics of interaction between teachers and students in the use of Google Sites. In-depth interviews were conducted with key and supporting

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informants to explore their experiences, perceptions, and reflections on the implementation of technology-based learning. Meanwhile, documentation studies were conducted by reviewing teaching modules, Google Sites digital archives, and students' work artifacts as supporting data that strengthen the field findings. Data analysis in this study adapted the interactive model from Miles, Huberman, and Saldaña (2014). The analysis process was carried out in a cyclical and continuous manner, not linearly, allowing the researcher to continuously reflect on and verify the data throughout the study.

To maintain the credibility and validity of the data, this study applies source triangulation and method triangulation techniques. Source triangulation is carried out by comparing information obtained from the principal, teachers, and students in order to see the consistency of meaning in the implementation of the 6Cs. Meanwhile, method triangulation is conducted through a combination of observation, in-depth interviews, and documentation of students' digital artifacts. A limited member checking process is also carried out by reconfirming the interpretation results with teachers as key informants. These steps aim to minimize interpretative bias and strengthen the validity of the research findings.

The stages of analysis include: (1) Data Collection, which is the process of gathering all information from observations, interviews, and documentation; (2) Data Condensation, which is the process of selecting, simplifying, and focusing on important data from interview transcripts and field notes; (3) Data Presentation, which is organizing the information in a systematic way in the form of a narrative or matrix to observe patterns of digital interaction and the implementation of 21st-century skills; and (4) Conclusion Drawing and Verification, which is the process of interpreting findings based on valid evidence and re-checking data consistency. A visualization of the data analysis flow can be seen in Figure 1.

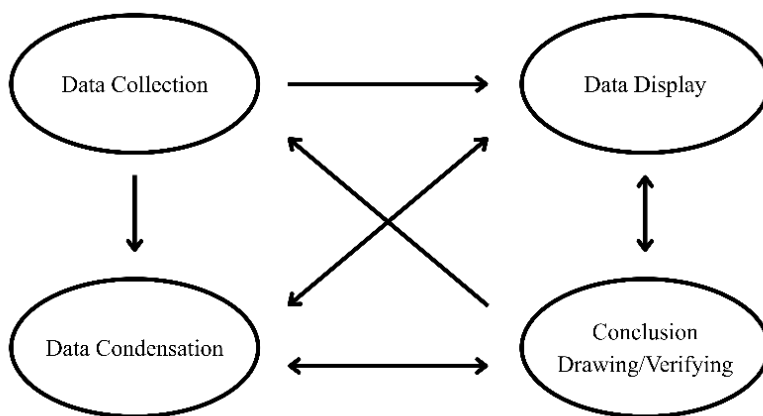


Figure 1. Components of Data Analysis: Interactive Model (Miles et al., 2014)

The systematic and transparent application of flow analysis is crucial in contemporary qualitative research to ensure the trustworthiness (trustworthiness) and accuracy (accuracy) of research results, as emphasized in recent methodological studies (Byrne, 2022).

### 3. Results and Discussion

The interview results show that conceptually, school leaders have a strong awareness of the urgency of 21st century skills (6C). The elementary school principal stated (W.01, B.01): *21st century skills are an important requirement for junior high school students so that they can adapt to the times, especially in the face of advances in technology and information. The school believes that students need to not only master academic knowledge, but also thinking skills, teamwork, and the wise use of technology in everyday life.*

To ensure the credibility of the findings, the identification of 21st-century skills (6C) in this study was conducted through data triangulation involving interviews, classroom observations, and documentation analysis. Interview data were obtained from the school principal, informatics teacher, and students, while observation data were derived from direct monitoring of project-based learning activities using Google Sites in the classroom. Documentation data included student website projects, learning modules, and assessment records related to ICT-based assignments. Through this triangulation process, the findings regarding the development of critical thinking, creativity, collaboration, communication, character, and citizenship were not only based on participant statements but were also confirmed through observed learning practices and documented student outputs.

This statement confirms that, at a conceptual level, the school has positioned the 6Cs as a strategic necessity in preparing students for digital transformation. This orientation indicates a paradigm shift from content-focused learning to learning that emphasizes thinking, collaboration, and technological literacy competencies. However, in another part, Mrs. SD also said (W.01, B.03): *Explicitly, the development of 6C has not been detailed in the school's vision and mission, but it has been reflected in learning modules and learning practices, particularly in Informatics subjects and ICT-based projects.*

This quote indicates that although there is normative and pedagogical awareness of the importance of 6C, its development has not been explicitly formalized in the school's strategic documents. In other words, the implementation of 6C at SMPN 6 Darangdan has been carried out at the practical level, but has not been fully institutionalized within the framework of formal policy. This condition shows a gap between ideological commitment and structural institutionalization. The school's vision and mission are essentially a representation of the direction of long-term development, so the absence of an explicit formulation of the 6Cs has the potential to make their implementation dependent on the initiative and interpretation of each teacher.

However, the fact that 6C is not explicitly mentioned in the vision and mission does not necessarily indicate a lack of implementation. On the contrary, field data shows that 6C values have been internalized in learning practices, especially through ICT-based projects in Informatics subjects. This shows that learning transformation in schools takes place through a practical approach before being confirmed in formal

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policies. From an educational management perspective, this phenomenon can be understood as classroom-driven innovation, where teachers are the main actors in driving pedagogical change.

Thus, to understand how the 6C values are concretely realized in learning practices, it is necessary to further examine the implementation of project-based learning that utilizes Google Sites as the main medium. The following analysis describes how this platform is integrated into the learning process and how it functions as an integrative pedagogical strategy in developing the six dimensions of 21st-century skills. The use of Google Sites in computer science education is part of the concrete practice of strengthening 21st-century skills at SMPN 6 Darangdan. At the policy level, Mrs. SD reiterated (W.01, B.01): *21st-century skills are an important requirement for junior high school students so that they can adapt to the times, especially in the face of advances in technology and information. The school believes that students not only need to master academic knowledge, but also thinking skills, collaboration, and the wise use of technology in everyday life.*

This statement shows that, conceptually, the school realizes that learning must integrate thinking skills, collaboration, and technological literacy. The implementation of Google Sites is one form of this orientation in practice. At the pedagogical level, Ms. RF, an information technology teacher, explained directly (W.02, B.01): *The application of Google Sites in ninth-grade information technology learning is carried out through group projects to create educational websites. Student design, create, and present websites using Google Sites. This activity trains critical thinking, creativity, collaboration, communication, computational thinking, as well as digital literacy and character.*

This excerpt shows that Google Sites is not used as an additional medium, but is integrated into project-based learning scenarios. The process of “designing, creating, and presenting” demonstrates systematic thinking and a focus on real products. Thus, Google Sites serves as a vehicle that combines various dimensions of 6C in one authentic activity. The integration of the critical thinking dimension is evident from the students' experiences. One student stated (W.03, B.02): *The part that made me think the hardest was arranging the layout and design of the website to make it look attractive and easy to navigate. For example, I had to try several times to create a responsive navigation menu.*

The statement “tried several times” indicates a process of reflection and self-evaluation in solving technical problems. Critical thinking does not arise through practice questions, but through the real need to improve the structure and appearance of the website. This indicates that learning takes place in the context of concrete and meaningful problem solving. This finding is also supported by classroom observation data, which show that students repeatedly revised the layout and navigation structure of their websites during the project process. The observation notes indicate that students frequently tested menu functions, rearranged page structures, and discussed alternative design solutions with group members. Furthermore, documentation of student websites demonstrates several iterations of layout changes before the final version was published. These

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observation and documentation data confirm that the development of critical thinking occurred through an iterative problem-solving process during website design activities. In terms of creativity, students said (W.03, B.03): *The part that made me most creative was the design and content of the website. I tried to create a unique and interesting design, and added relevant images and videos.*

In addition, another student stated (W.03, B.19): *Yes, the teacher gave us the freedom to choose topics. This made me more creative and motivated to create an interesting website.* The freedom to choose topics shows that there is autonomy in learning. Creativity develops not because of rigid instructions, but because students are given the opportunity to determine the direction and identity of their work. Thus, Google Sites becomes a medium for digital expression that encourages the exploration of ideas and visual innovation.

The development of creativity was also confirmed through documentation analysis of student website projects. The collected documentation shows a variety of visual themes, color schemes, multimedia integration, and content presentation styles across different groups. Classroom observations further indicate that students experimented with different page layouts, image placements, and embedded videos to improve the attractiveness of their websites. These findings support the interview data, indicating that creativity emerged not only from students' perceptions but also from observable variations in their digital products. The dimension of collaboration is evident from the following student statement (W.03, B.04): *Yes, I worked with my friends. We divided the tasks based on our respective skills, then we discussed to solve problems together.*

This statement shows that group work was carried out in a structured and role-based manner. Collaboration was not limited to working together, but involved discussion, negotiation, and collective responsibility for the final result. This process shows that the website project became an authentic social learning space. Observation data also confirm the collaborative nature of the project-based learning process. During classroom activities, students were observed dividing roles such as content creator, designer, and editor within their groups. They frequently discussed navigation problems, reviewed each other's work, and collectively decided on the final structure of the website. In addition, documentation of group project reports shows task distribution among members, further supporting the interview findings that collaboration occurred through structured teamwork during the project. Meanwhile, the dimensions of character and citizenship are reflected in the emphasis on digital ethics. Mrs. RF stated (W.02, B.18): *The character traits emphasized are discipline, responsibility, cooperation, and honesty, which are instilled through group task distribution, deadline setting, work process monitoring, and attitude assessment throughout the project.* This is reinforced by students who stated (W.03, B.12): *Our teachers emphasize the importance of using the internet wisely and politely, and not sharing personal information online.*

The quote shows that Google Sites-based learning is not only oriented towards technical website creation skills, but also towards character building and ethical digital literacy. Students learn that digital content production has social and moral

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consequences. The integration of character and citizenship values was also reflected in learning documentation and classroom observation. The project guidelines provided by the teacher included instructions on responsible internet use, proper citation of digital sources, and ethical online behavior. Observation notes further show that the teacher consistently reminded students to verify information sources and avoid sharing personal data on their websites. These findings demonstrate that the development of digital character and citizenship was embedded not only in teacher instructions but also in the documented learning procedures and classroom practices.

Analytically, these findings show that Google Sites functions as an integrative pedagogical medium. This platform allows for the integration of critical thinking, creativity, collaboration, communication, character, and citizenship in a series of interrelated activities. The success of this integration does not lie in the complexity of the technology, but rather in the project-based learning design that places students as the main actors in building and reflecting on their digital knowledge. Thus, the implementation of Google Sites at SMPN 6 Darangdan shows that even simple technology can be an instrument of learning transformation when integrated pedagogically and reflectively. Overall, the integration of the six dimensions of 21st-century skills in this study was validated through triangulated evidence. Interview data provided insights into participants' perceptions and experiences, observation data captured the real dynamics of project-based learning activities, while documentation analysis revealed the tangible outputs of student learning in the form of Google Sites projects. The convergence of these three data sources strengthens the credibility of the findings and confirms that the development of the 6C occurred through authentic learning practices rather than through isolated perceptions.

Reflective pedagogical design in the context of this study can be understood as learning design that places students as active subjects in constructing knowledge through a cycle of experience, reflection, revision, and presentation of results. Based on social constructivism theory, effective learning occurs when students interact with authentic problems, engage in dialogue with peers, and reflect on their thinking processes. In the project-based learning practice found at SMPN 6 Darangdan, this cycle is evident when students design website structures, revise designs after encountering navigation issues, and present their results to obtain feedback. The process of "trying several times," as expressed by the students, is not merely a technical activity but a form of metacognitive reflection that demonstrates the internalization of critical thinking. Conceptually, reflective pedagogical design is also in line with the project-based learning approach, which emphasizes authentic and collaborative problem solving as a vehicle for integrating 21st-century skills. Previous research shows that the effectiveness of 6C development is determined more by the quality of the learning scenario, such as the provision of autonomy, space for exploration, and authentic assessment, than by the sophistication of the digital platform used. Thus, based on field findings and theoretical support, reflective pedagogical design in this study is characterized by three main features: (1) authentic project-based learning, (2) space for autonomy and creative exploration for students, and (3) reflective practices through revision and

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presentation. These are the key factors in the effectiveness of strengthening the 6Cs, not merely technological features.

Theoretically, these findings can be explained through the perspective of social constructivism, which places learners as active actors in constructing knowledge through interaction and authentic experiences. Project-based learning using Google Sites creates space for students to construct meaning through direct practice, reflection, and social collaboration. Within the framework of 21st-century skills, the integration of the 6Cs does not occur separately, but rather is interconnected within a single digital learning ecosystem. Critical thinking develops when students face website design and navigation problems; creativity emerges through visual and content exploration; collaboration and communication are formed through the negotiation of meaning in group work; while character and citizenship are internalized through the practice of responsible digital publishing. This shows that technology acts as a pedagogical mediator, not just a technical tool.

Furthermore, the findings of this study reinforce the argument that the integration of technology in secondary education should not be understood as a process of digitizing content alone, but rather as a transformation of pedagogical practices. Google Sites in this context functions as a digital learning space that enables multimodal, reflective, and participatory learning. Thus, the effectiveness of strengthening the 6Cs is determined more by the design of authentic and contextual learning activities than by the complexity of the technology features themselves. This perspective is in line with the Merdeka Curriculum approach, which emphasizes meaningful learning and the strengthening of students' holistic competencies.

In the literature of educational technology integration, the complexity of technology is often associated with the sophistication of features, the level of system interactivity, and the user's technical competence requirements. Many studies emphasize that platforms with advanced multimedia features, integrated learning management systems, or artificial intelligence support are believed to enhance engagement and learning outcomes. However, recent research also shows that high technological complexity does not always correlate with learning depth if not accompanied by proper pedagogical design.

Findings in this study show that Google Sites, which is technically categorized as a simple platform and does not require programming skills, is able to facilitate the integration of 6C effectively. This indicates that technological complexity is not the main determining variable, but rather serves a facilitative role. Technology functions as a medium that expands learning space, while the quality of interaction, collaboration, and reflection is still determined by the teacher's strategy in designing activities. Thus, technological complexity in this context is positioned as a supporting factor, not a determinant, and the effectiveness of learning relies more on how the technology is understood and integrated into pedagogical practice.

Nevertheless, the success of 6C integration through Google Sites does not occur without challenges. Field learning practices show that the process is also influenced

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by various structural factors that determine the depth and consistency of its implementation. Therefore, to obtain a more comprehensive picture, it is important to examine the obstacles that arise during the implementation of project-based learning. The interview results show that the implementation of Google Sites-based learning in developing 6C skills is not without various structural obstacles. Mrs. RF, an IT teacher, stated (W.02, B.10): *The obstacles faced include limited devices and internet networks, limited learning time, and differences in students' readiness and digital literacy skills.*

The statement indicates that the main obstacles lie in the aspects of infrastructure and student readiness. Limited devices and internet networks become fundamental challenges, considering that website-based learning heavily depends on stable access to technology. In addition, differences in students' digital literacy show the existence of an initial competency gap that affects the speed and quality of project completion. This finding is reinforced by the statement of Mrs. SD, the school principal, who emphasized (W.01, B.08): *The main challenges include limitations in facilities, networks, and devices, as well as differences in the readiness of students and teachers in utilizing technology.*

The quote shows that the obstacles are not only technical but also involve the readiness of human resources. This means that the implementation of Google Sites requires not only student readiness but also teachers' pedagogical competence in managing technology-based learning. Analytically, infrastructure limitations directly affect the effectiveness of 6C integration. When access to devices and networks is unstable, learning time may be focused on resolving technical issues rather than strengthening critical thinking or creativity skills. This condition has the potential to reduce the depth of students' reflection and exploration. In addition, differences in students' digital literacy make classroom dynamics non-homogeneous; some students can complete tasks more quickly, while others require intensive guidance. This demands differentiated learning strategies to ensure that the objectives of 6C development are achieved evenly.

Teacher readiness is also a crucial factor. The integration of technology in learning is not merely the ability to operate platforms, but also the ability to design meaningful activities, manage collaboration, and conduct authentic assessments. If this competence is not yet evenly distributed, then the effectiveness of implementation has the potential to vary between classes or teachers. If time is limited, then the process has the potential to become rushed and less optimal in building depth of competence. Nevertheless, these structural constraints do not completely hinder implementation, but rather become challenges that encourage adaptation. Teachers need to adjust strategies, such as more structured task distribution, rotating use of devices, or providing additional assistance to students who are experiencing difficulties. In other words, the obstacles that arise actually reflect the real dynamics of learning transformation at the school level.

Overall, these findings indicate that the effectiveness of implementing Google Sites in integrating the 6C not only depends on pedagogical design but also on infrastructure support and human resource readiness. Without the enhancement of

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facilities, the improvement of teacher capacity, and adequate time management, the integration of the 6C has the potential to be suboptimal and uneven. Therefore, the sustainability of technology-based learning innovations requires synergy between school policies, ICT infrastructure strengthening, and continuous professional development of teachers. To provide a more systematic analysis of the relationship between project-based learning activities and the development of 21st-century skills (6C), a thematic matrix was constructed based on the triangulation of interview, observation, and documentation data. This matrix summarizes the main learning activities carried out through Google Sites projects and their contribution to each dimension of the 6C skills (Table 1).

Table 1. Thematic Matrix of Project-Based Learning Activities and 6C Skills Development

Theme	Frequency	Key Sources	Main Findings
Website Design and Navigation Problem Solving (Critical Thinking)	4x	W.02 B.01; W.03 B.02; Obs; Doc	Students repeatedly revised website layout and navigation structures to improve usability. This iterative design process reflects reflective thinking and problem-solving skills in authentic digital tasks.
Digital Content and Visual Design Creation (Creativity)	4x	W.03 B.03; W.03 B.19; Obs; Doc	Students explored various visual layouts, multimedia elements, and unique website themes. Autonomy in choosing topics encouraged students to express creative ideas through digital media.
Group Work and Task Distribution (Collaboration)	3x	W.03 B.04; Obs; Doc	Students worked collaboratively in groups by dividing roles such as content creator, designer, and editor, demonstrating teamwork and collective responsibility.
Website Presentation and Idea Explanation (Communication)	2x	W.02 B.01; Obs	Students presented their websites and explained design decisions and content structures to peers, strengthening communication skills in digital learning environments.
Responsibility and Learning Discipline (Character)	3x	W.02 B.18; Obs; Doc	Teachers emphasized responsibility, honesty, and discipline through task monitoring, deadline management, and participation assessment during the project process.
Ethical Internet Use and Digital Responsibility (Citizenship)	2x	W.03 B.12; Doc	Students were guided to use internet resources responsibly, verify information sources, and avoid sharing personal data online, reflecting digital citizenship values.
Structural Challenges in Technology Integration	3x	W.02 B.10; W.01 B.08	Implementation challenges include limited devices, unstable internet networks, limited time allocation, and differences in digital literacy among students and teachers.

The thematic matrix above shows that each dimension of the 6C competencies emerges through specific learning activities within the project-based learning process. Critical thinking develops through iterative problem solving when students design and revise website structures. Creativity emerges through the exploration of digital content and visual layouts. Collaboration and communication occur through group discussions, role distribution, and project presentations. Meanwhile, character and citizenship are developed through the practice of responsibility, ethical internet use, and digital literacy awareness. These findings indicate that the integration of 21st-century skills occurs holistically through authentic project experiences rather than through isolated instructional activities.

#### 4. Conclusion

This study shows that the implementation of Google Sites in Informatics learning for 9th grade students at SMP Negeri 6 Darangdan effectively supports the development of 21st-century skills (6C) through student-centered project-based learning. Critical thinking and creativity skills develop through the process of analyzing and designing websites, while collaboration and communication are formed through teamwork and result presentations. The dimensions of character and citizenship are internalized through digital responsibility practices in creating ethical and original content. These findings affirm that the success of strengthening 21st-century skills does not depend on the complexity of technology, but rather on a pedagogical design that is contextual, reflective, and aligned with the principles of the Independent Curriculum. Nevertheless, this study also identified structural constraints such as limited infrastructure and technical readiness that could potentially affect the sustainability of implementation, thus systemic support from schools and policymakers is needed. Theoretically, this study enriches qualitative research on the integration of web-based media in Informatics learning at the junior high school level by emphasizing students' learning processes and experiences. Practically, the research findings imply that simple platforms like Google Sites can become instruments for digital learning transformation if designed systematically. Further research is recommended to use comparative or mixed-method approaches to more quantitatively measure the 6C dimensions and test the consistency of findings in different school contexts, thereby obtaining broader generalizations regarding the effectiveness of digital platform integration in secondary education.

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