

Digital Feedback and Learning Quality: Behaviorist, Cognitive, and Constructivist Perspectives

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ABSTRACT

Digital transformation in education has encouraged the utilization of various learning technologies that enable feedback to be delivered in a faster, more interactive, and adaptive manner. This article aims to examine the role of digital feedback in improving learning quality from behaviorist, cognitive, and constructivist perspectives. The study employed a library research approach by analyzing scientific articles, academic books, and reports from international organizations published over the last five years. Data were analyzed through thematic analysis and narrative synthesis to identify the concepts, characteristics, and pedagogical implications of digital feedback in learning. The findings indicate that digital feedback is characterized by timeliness, personalization, interactivity, and data-driven features that support more effective and learner-centered instruction. From the behaviorist perspective, digital feedback serves as reinforcement of learning behaviors; from the cognitive perspective, it facilitates information processing and metacognitive development; and from the constructivist perspective, it promotes reflection, collaboration, and knowledge construction. These findings demonstrate that digital feedback constitutes an important pedagogical component in fostering adaptive, participatory, and meaningful learning.

Keywords: *Behaviorist Perspective, Cognitive Perspective, Constructivism, Digital Feedback, Learning Quality.*

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1. | INTRODUCTION

Digital transformation has brought very significant changes in various aspects of life, including in the field of education. The use of digital technology is no longer seen as just a means of supporting learning, but has become an integral part of the modern education ecosystem that demands a more adaptive, interactive, and student-centered learning process (UNESCO, 2021; OECD, 2021). The development of various digital learning platforms, learning management systems, learning analytics, and artificial intelligence-based technologies opens up new opportunities for educators to manage learning more effectively and responsive to the learning needs of students (UNESCO, 2023; OECD, 2023). This change also requires pedagogical innovation that is able to optimize the use of technology to improve the quality of learning processes and outcomes.

One of the important components of technology-based learning is providing feedback. Feedback is information provided to learners about their performance, process, or learning outcomes with the aim of helping improve understanding, learning strategies, and achieving learning goals. In the context of digital education, the concept of feedback has evolved into digital feedback, which is feedback provided through the help of digital devices or platforms in a faster, systematic, and personalized manner. The presence of digital feedback allows students to obtain information about learning progress in real-time and provides wider opportunities for continuous reflection and improvement (Irons & Elkington, 2022; Carless, 2023).

Various studies show that digital feedback has great potential in improving the quality of learning. Feedback provided in an adaptive and technology-based manner has been proven to support the development of self-regulated learning, increase learning engagement, and help learners build more effective learning strategies (Mejeh et al., 2024; Yong & Sokumaran, 2023). In addition, the use of personalized and data-driven feedback also has a positive impact on the motivational and emotional aspects of students because the information provided is more in line with individual needs and characteristics (Weidlich et al., 2024). In fact, the results of the latest meta-analysis show that appropriately designed digital feedback can have a significant influence on improving students' learning performance and academic achievement (Learning Environments Research, 2024).

From a pedagogical perspective, digital feedback is not only understood as the delivery of corrective information, but also as an instrument that supports meaningful learning. The use of learning data and digital analytics allows educators to identify learning difficulties more quickly and provide more accurate follow-up recommendations (Huang et al., 2024). In addition, the development of digital technology allows the creation of various forms of interactive feedback, such as multimedia comments, learning progress dashboards, and automated feedback that can

help students monitor their learning progress independently (Tinajero et al., 2024; Permatasari et al., 2024).

However, the implementation of digital feedback still faces various challenges. Digital competency gaps, infrastructure limitations, and differences in students' readiness to utilize technology often cause the effectiveness of digital feedback to be suboptimal (UNESCO, 2023; World Bank, 2022). In addition, the use of technology that is not designed based on pedagogical principles can produce feedback that is too simple, mechanistic, or even cause information overload that hinders the learning process (Carless & Winstone, 2023). Therefore, the use of digital feedback requires a strong conceptual and theoretical foundation so that technology not only functions as a medium for conveying information, but also becomes a means that is able to develop students' learning capacity comprehensively.

To understand the role of digital feedback more deeply, a study is needed that places digital feedback in the perspective of learning theory. The behavioristic perspective views feedback as a form of reinforcement that can shape learning behavior through direct and consistent responses. The cognitive perspective sees feedback as information that helps the information processing process, reduces cognitive load, and develops students' metacognitive abilities. Meanwhile, the constructivist perspective places feedback as a means of dialogue that encourages reflection, collaboration, and knowledge construction independently and socially (Guo, 2020; Gaul & Kim, 2020; Veugen et al., 2024). These three perspectives provide a complementary conceptual framework in understanding how digital feedback can be used to improve the quality of learning in various educational contexts.

Based on this description, this article aims to examine the role of digital feedback in improving the quality of learning by examining the concepts and characteristics of digital feedback and analyzing its implementation based on behavioristic, cognitive, and constructivist perspectives. This study is expected to make a theoretical contribution to the development of the literature on digital feedback as well as a practical reference for educators and educational technology developers in designing feedback systems that are more adaptive, informative, and centered on the learning needs of students in the digital education era.

2. | RESEARCH METHOD

This research uses a library research approach that aims to review, analyze, and synthesize various scientific literature regarding the role of digital feedback in improving the quality of learning. The literature study approach was chosen because this research is not oriented to collect field data, but to an in-depth study of previously published concepts, theories, and empirical findings. Through a literature review, researchers can gain a comprehensive understanding of the development of the concept of digital feedback, the characteristics of its implementation in learning, and its relevance from behavioristic, cognitive, and constructivist perspectives. This approach also allows the preparation of an integrative conceptual framework so that it can explain

the relationship between digital feedback and improving the quality of learning in a more systematic and in-depth manner.

The data sources in this study are in the form of secondary data obtained from various scientific documents, including indexed international and national journal articles, academic books, proceedings, reports of international institutions, and other scientific publications relevant to the research theme. The literature search process is carried out systematically through scientific databases and academic search engines, such as Google Scholar, Scopus, ERIC, SpringerLink, ScienceDirect, and Taylor & Francis Online. Keywords used in the literature search include "digital feedback", "online feedback", "formative assessment", "technology-enhanced feedback", "feedback literacy", "self-regulated learning", "learning analytics", "educational technology", and "artificial intelligence in education". To maintain the relevance and actuality of the study, the literature used was limited to publications of the last five years.

The selection of literature sources is carried out through several inclusion criteria, namely: (1) literature published in the last five years; (2) discussing digital feedback or concepts related to technology-based feedback in the context of education; (3) contain conceptual, theoretical, and empirical research discussions that are relevant to improving the quality of learning; and (4) come from sources that can be accounted for academically. Meanwhile, literature that has no direct relevance to the research focus, is not fully available, or does not meet the standards of scientific publications is excluded from the analysis process.

The data that has been collected is then analyzed using thematic analysis and narrative synthesis techniques. Thematic analysis is carried out by identifying, grouping, and interpreting the main themes that emerge from various literature, including the concept and characteristics of digital feedback, the implementation of digital feedback in learning, and digital feedback analysis based on behavioristic, cognitive, and constructivist perspectives. Furthermore, the narrative synthesis technique is used to integrate various research findings into a complete and coherent argument about the role of digital feedback in improving the quality of learning. Through the analysis process, this research produces a comprehensive conceptual understanding and provides a theoretical and practical foundation for the development of learning strategies that utilize digital feedback more effectively, adaptively, and oriented to the learning needs of students.

3. | RESULTS AND DISCUSSION

A review of various literature shows that digital feedback has developed into one of the important components of modern learning. The development of educational technology allows the feedback process to no longer rely entirely on face-to-face interaction and manual correction by educators, but can be done through various digital platforms that provide information quickly, adaptively, and continuously. In the context

of 21st century education, digital feedback is seen as a mechanism that supports learning that is more responsive to the needs of learners because it allows the process of evaluation and improvement of learning to take place in real-time. This transformation is in line with the global agenda of education which emphasizes the importance of technology integration to improve the quality and equity of learning (UNESCO, 2021; OECD, 2023).

Conceptually, digital feedback is information about the learning process or outcomes delivered through digital media with the aim of helping students understand their level of learning achievement and determine the necessary improvement steps. In contrast to conventional feedback which is often given in a delayed and general manner, digital feedback has the main characteristics in the form of timeliness, personalization, interactivity, and the ability to present learning development data in a more structured manner. These characteristics allow learners to obtain information that is more relevant to their learning needs so that it can increase the effectiveness of the learning process (Irons & Elkington, 2022; UNESCO, 2023). In addition, the development of learning analytics and artificial intelligence allows for the presentation of feedback that is increasingly adaptive and based on the analysis of individual learning patterns (OECD, 2021; OECD, 2023).

Various empirical studies show that digital feedback has a positive influence on the quality of learning. Providing adaptive feedback has been proven to help students develop self-regulated learning skills through increasing awareness of learning goals, monitoring progress, and continuous self-evaluation (Mejeh et al., 2024; Tinajero et al., 2024). The findings show that digital feedback not only functions as an evaluation tool, but also as a means to build learning independence. The use of learning progress dashboards, material recommendations, and performance indicators allows students to identify their strengths and weaknesses more accurately so that they can develop more effective learning strategies (Permatasari et al., 2024; Huang et al., 2024).

From a behavioristic perspective, digital feedback can be understood as a form of reinforcement that functions to shape learning behavior through providing quick and consistent responses. The basic principle of behaviorism emphasizes that learning occurs through a relationship between stimulus and response that is reinforced by reinforcement. In the context of digital learning, various learning applications and learning management systems provide automatic feedback in the form of scores, notifications, true-false indicators, and digital rewards that are given as soon as students complete a learning activity. The speed and consistency of such feedback makes digital feedback an effective means to reinforce expected learning behaviors and reduce repeated mistakes (Guo, 2020; Weidlich et al., 2024).

In addition, the immediate feedback characteristics of the digital system allow students to immediately know the results of their actions. This condition supports the formation of more disciplined and directed learning habits because students get direct consequences for each response given. Various digital learning platforms also integrate

gamification elements, such as points, badges, and achievement levels, which serve as a positive reinforcement of learning engagement. Research shows that feedback given quickly and specifically can increase motivation and encourage learners to repeat learning behaviors that are considered successful (Mejeh et al., 2024; Yong & Sokumaran, 2023). Thus, the behavioristic perspective views digital feedback as an effective instrument for developing learning habits through systematic reinforcement mechanisms.

From a cognitive perspective, digital feedback is seen as information that helps learners process, organize, and improve their understanding of learning materials. Cognitive theory places mental processes as the main factor in learning so that the feedback given must be informative, clear, and able to direct students in building a better knowledge structure. Digital technology allows the presentation of feedback in various forms, such as text, audio, visual, and multimedia combinations that can help students understand mistakes and improve their learning strategies more effectively (Huang et al., 2024; OECD, 2021).

The use of digital feedback is also closely related to cognitive load management. Information that is presented in stages and structured can help students focus attention on important aspects so as to reduce cognitive overload. The presence of learning analytics allows students to get an overview of their learning progress through data that is easy to understand and relevant to individual needs. This information encourages the development of metacognitive abilities because students can conduct self-monitoring and self-evaluation more systematically (Tinajero et al., 2024; Permatasari et al., 2024). Other research shows that data-driven feedback can improve problem-solving skills and deeper conceptual understanding as learners gain information that supports the process of reflection and learning decision-making (Huang et al., 2024; Yong & Sokumaran, 2023).

The constructivist perspective provides a broader view of digital feedback by placing it as part of a social and reflective knowledge construction process. In this approach, feedback is not understood as one-way instruction from educators to learners, but as a dialogical process that allows learners to build understanding through reflection, interaction, and collaboration. The development of digital technology presents various features that support this process, such as discussion forums, collaborative comments, peer feedback, and co-working spaces that allow learners to exchange ideas and revise their understanding repeatedly (Gaul & Kim, 2020; Veugen et al., 2024).

Various studies show that digital feedback that is dialogical in nature can increase learning engagement and strengthen students' self-regulation skills. When students are given the opportunity to interpret feedback, discuss with peers, and develop solutions to the difficulties they face, the learning process becomes more meaningful and student-centered. This condition is in line with the concept of literacy feedback which emphasizes the importance of students' ability to understand, interpret, and utilize

feedback to improve the quality of their learning (Carless, 2023; Carless & Winstone, 2023). Thus, the effectiveness of digital feedback is not only determined by the quality of the technology used, but also by the ability of students to construct the meaning of the information received.

Despite its various advantages, the implementation of digital feedback still faces a number of challenges. One of the main problems is the digital competency gap between educators and students. Not all educators have adequate abilities to design informative and learning-oriented digital feedback. On the other hand, students also show different levels of readiness in utilizing technology to support the learning process. Limited infrastructure, uneven internet access, and differences in the availability of digital devices are still obstacles to the optimal implementation of educational technology (UNESCO, 2023; World Bank, 2022).

In addition to technical factors, other challenges relate to the pedagogical design of digital feedback. The use of technology that focuses too much on automation can result in feedback that is mechanistic and only conveys true-false information without providing explanations that encourage deep understanding. In some situations, students can also experience information overload due to receiving too much information in a short time. This condition has the potential to reduce learning motivation and hinder students' ability to interpret feedback effectively (Carless & Winstone, 2023; Weidlich et al., 2024). Therefore, the use of digital feedback requires planning that takes into account pedagogical principles, student characteristics, and learning objectives to be achieved.

Overall, the results of the study show that digital feedback has a significant contribution to improving the quality of learning if it is designed and implemented appropriately. From a behavioristic perspective, digital feedback serves as a reinforcement that helps shape desired learning behaviors. From a cognitive perspective, digital feedback supports the process of information processing, the development of metacognition, and the strengthening of conceptual understanding. Meanwhile, the constructivist perspective places digital feedback as a means of reflection and collaboration that allows students to build knowledge in a more meaningful way. The integration of these three perspectives shows that digital feedback is not just a technology-based evaluation tool, but a pedagogical component that has great potential to realize more adaptive, participatory, and lifelong learning skills development (UNESCO, 2021; OECD, 2023).

4. | CONCLUSION

Digital feedback is one of the pedagogical innovations that has a strategic role in improving the quality of learning in the era of digital education. The presence of various learning platforms and technologies allows the feedback process to be carried out more quickly, adaptively, interactively, and continuously so that students get more accurate information about their learning progress. These characteristics make digital feedback not only function as a means of evaluation, but also as an instrument that helps students

understand mistakes, improve learning strategies, and develop independent learning skills.

Viewed from a behavioristic perspective, digital feedback serves as a form of reinforcement that encourages the formation of expected learning behaviors through direct and consistent responses. From a cognitive perspective, digital feedback plays a role in supporting information processing, developing metacognitive skills, and helping students build a more structured and in-depth understanding. Meanwhile, a constructivist perspective views digital feedback as a means of dialogue that facilitates reflection, collaboration, and active knowledge construction so that learning becomes more meaningful and student-centered.

Although its implementation still faces various challenges, such as digital competency differences, infrastructure limitations, and the need for appropriate pedagogical design, digital feedback still has enormous potential to support a more effective and inclusive educational transformation. Therefore, the development and utilization of digital feedback needs to be designed holistically by considering the characteristics of students, learning objectives, and the integration of various perspectives of learning theories in order to make an optimal contribution to improving the quality of learning processes and outcomes in various educational contexts.

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Data Disclosure Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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